ORIGINAL MEMOIRS.

SURGICAL INTERVENTION IN TUBERCULOSIS OF THE MENINGES AND OF THE BRAIN.[1]

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How frequently the meninges and the brain are affected by tuberculous lesions is too well-known to detain us. It is in childhood that the greatest number of cases occur. It is almost always a question of secondary tuberculous localisation, and often the final phase of a glandular, visceral or osseous tuberculosis which at a given moment breaks out in the miliary form.

For our purpose it is important to keep in mind that the greater number of cases also present anatomo-pathologically diffuse lesions, in form of exudations or multiple nodi, such as the eruption of tubercles upon the meninges and along the vessels, and that generally as their seat they prefer the base,— now the base alone, now together with the convexity in greater or less extent,—and sometimes also the spinal meninges; this signifying that in the greater number of cases, the intervention of the surgeon is impossible.

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[1] Read at the International Congress of Tuberculosis in Paris, October, 1905.

However, we know also a limited form of tuberculosis of the meninges and of the brain; tuberculous gumma, tuberculous conglomeration.   Oftenest it at the same time affects the meninges and the cortex, and sometimes is isolated in the depth of the brain substance.   This form of tuberculosis is in its clinical aspect quite different.

All this is well known; it suffices to mention it.   What is also well established is that the frequency of occurrence of the two forms is very different.   And the proportions change, according as we consider children or adults.   I think it is useless to repeat here figures that can easily be obtained from the numerous statistics published.

We have then to distinguish in their anatomo-pathological and clinical aspects, tuberculous meningitis, and the solitary tubercle of the brain.

It is true that between the two forms a distinction in the true sense does not exist, and we can pass from one to the other by numerous intermediary degrees.   It is equally true that the two forms are often united, and we find one or several masses of tubercles at the same time with a more or less diffuse lesion of the meninges, a classic meningitis contemporary or consecutive.

In any case the two varieties are very distinct in their typical forms and the possibility and the results of surgical intervention must be considered separately, according as we treat of the one or of the other.

Of Intervention in tuberculous Meningitis. I have already said that in tuberculous meningitis in general, surgical intervention is considered almost impossible.   However, I do not think the following considerations will be without their value:

(*a*) Tuberculous meningites do not all present themselves under the form of miliary eruption, they are not all equally diffuse, nor in the same region of the brain.

(*b*) Although of very rare occurrence, a spontaneous healing of the process is nowadays considered possible.

That being so, will Surgery never be able to lend assistance?

(*a*) As to the first point, numerous researches tend now-

adays to compel our admission that lesions of the meninges are sometimes limited, and present a course that has not the usual forms. I will only mention the well known essay of Chantemesse [1] in which he clearly established the special form of tuberculous meningitis *en plaque*, with quite special anatomical and clinical characters: it consists most frequently of confluent grey granulations, of yellowish pseudo-membranes or fibrous scleroses. The seat may be limited to the convexity of the brain and often to the region of the psychomotor centres.

Chantemesse distinguishes primary and secondary forms. Madeleine [2] justly remarks that we can, at most, speak of meningites which are clinically primitive without being anatomically so in every case.

See also the cases reported by Combe[3] and by Monnier.[4]

Trevelyan,[5] in 114 cases of tuberculosis of the nervous system, observed during a course of twenty years at the " Leeds General Infirmary " reports nine of this class in which there were observed thickenings localised over a limited extent of the cortex (Meningitis en plaque).

It must be observed that he clearly distinguishes these last cases from those with tuberculous masses (solitary tubercles) in the brain, of which he reports 33 in 114 cases, as we shall see later on.

A similar case calls for consideration, namely, that of Tuffier,[6] who operated a phthisical patient, aged twenty-nine years, suffering also from spasms and paralysis, and affirms that it was not a matter of solitary tubercle, but a plaque of tuberculous meningo-encephalitis. Sænger [7] reports also three cases of tuberculous lesions localized in the meninges, of which one in the left sylvian fissure in a woman of thirty-two years, another in both sylvians, in a man of fifty-eight, the third in the left sylvian in a man of fifty-two. Corresponding with the locality of the lesions there were focal clinical symptoms; in the first case, aphasia and right hemiplegia; in the third case right hemiplegia. It is to be observed that these were adults. We see from this that there exist cases, although rare, of lesions of the meninges of the ordinary type, but limited.

In the statistics given by Weingärtner [8] of 245 cases in the anatomo-pathological institute of Kiel there was not one

that exhibited circumscription in the convexity.   Leitz,[9] on the other hand, reports 3 cases of it in 67 (adults).

In this connection I wish to give four years' statistics from autopsies made at the school of Pathological Anatomy of the University of Rome.   I owe them to the kindness of Professor Marchiafava, the Director, and his assistants, Doctors Nazari and Ugolini, who have been so good as to furnish me with them.

In about 1200 autopsies there have been in all 57 cases of tuberculosis of the meninges and of the brain.

As to Age.—Fourteen cases were children below five, fifteen between five and ten years, eleven between ten and fifteen, nine between fifteen and twenty, and eight above twenty years.

In this respect these data do not show much difference from statistics already known.

As to the anatomical form it was always meningitis more or less diffuse.   In one case only (a man of thirty-seven years) there were solitary cortical tubercles in the left hemisphere.

Of the 56 cases, in 54 the meningitis had its seat at the base, and in these 54, ten had also reached the vault and oftenest in limited points as follows: above the right parietal lobe, at the foot of the first and second frontals, along the pararolandic, once with extensive softening of the left cerebral hemisphere (paracentral circonvolutions and parietal lobe).

Finally twice the tuberculous lesion was limited to the convexity of the brain, more particularly, once especially to the right half, and the other time especially on the paracentrals.

I do not intend to dwell on this point, nor to draw conclusions from a small number of cases.

I have given the above data, because in a question of such difficulty every contribution is interesting, and because I intend to weigh all the possibilities in order with more confidence absolutely or partially to reject surgical intervention.

(*b*) The healing of tuberculous meningitis is to-day considered possible, and medical literature reports some cases of it.   With respect to this, Trevelyan justly remarks that we must make a distinction between the ordinary diffuse meningitis and meningitis circumscribed en plaque.

It is certain that compared with the enormous quantity of cases followed by death those cured would represent a small proportion: however there have been some. Even if we consider doubtful those adduced by Politzer,[10] by Rillett,[11] and perhaps even those by Barth,[12] Cadet Gassicourt,[13] and Carrington,[14] in which all the same a healing of the lesion was anatomically demonstrated—that also reported by Dujardin Beaumetz[15] in which tubercles were discovered in the choroid—and those by Cufer,[16] Chappet,[17] and Ward,[18] in which the diagnosis was based upon the presence of tuberculous lesions in other parts of the organism,—still there are other cases that do not admit of doubt. Thus the case reported by Freyhan,[19] in which bacilli were discovered at the lumbar puncture, and in which none the less the patient was cured and survived five years in constant good health without further symptoms. Jannsen's[20] patient died, three years after, of pulmonary tuberculosis, and the autopsy showed along the longitudinal fissure a soft yellowish mass consisting of round nodi of detritus, and in different parts of the pia mater of grey perivascular nodi. Henkel's[21] patient (bacilli in the spinal liquid) was still well after a year. Mermann [22] also reports a case of typical tuberculous meningitis, which seemed cured and the subject well for four months; then there was a return of the symptoms and death after ten days; on the examination after death typical tuberculous meningitis was proved.

If, as the author believes, this last case proves that there is always a tendency to relapse, or rather to a recrudescence of the process, and that consequently we have only an apparent cure, it loses nothing of its values as evidence.

Besides in all surgical tuberculoses and especially in osseous and articular tuberculosis, we have cures we call clinical or apparent, which are none the less true cures properly so called and may even become complete in the true anatomopathological sense of the word.

Let us consider also the later cases of Rocaz [23] (the diagnosis was based on the seroreaction of Arloing Courmont) reported and anatomically demonstrated by Cruchet,[24] those of K. Barth,[25] with discovery of bacilli; of Gross,[26] equally with positive discovery of bacilli resisting acids and of the morphol-

ogical type of Koch; of Thomalla,[26] with tubercles in the choroid, of Sepet,[27] (seroreaction); of Winkler and Gohl,[28] with positive discovery of bacilli; of Mottard, [29] anatomically confirmed.

An important case has lately been communicated by Avanzino [30] of the Pammatone hospital at Genoa : the diagnosis of tuberculosis was based upon lesions of the optic papilla, on the leucocyte proportion of the liquid obtained from the lumbar puncture, and on the positive result of inoculation in guinea pigs.

See also the case I myself have operated and which I report below. Sepet[31] supports the opinion of Poncet, that is to say that we can have, fairly often, benign forms of tuberculous meningitis capable of cure and he distinguishes four anatomical varieties of it, among which he includes a light curable form of tuberculous meningitis, whose healing is due to attenuation of the virulence of the bacilli, or to increased resistance of the organism.   We may add that to this last case probably belong a large number of limited or partial meningitis.   See also with regard to this, the articles of Mollard and André,[32] of Dor,[33] of Bondet,[34] and Parrenin's [35] essay.

Maragliano[36] also admits the possibility of cure in some cases and he believes, that for this purpose, it may be useful to prevent, if one can, the mechanical effects of exudation. " Surgery alone," he says, " can answer this necessity in serious cases of richly fibrinous and stratified exudations."

To obtain decompression, besides the lumbar puncture, punctures have been tried of the lateral ventricles, of the fourth ventricle and its reservoir; in the well known case brought forward by Hord,[37] as there was coma and marked phenomena of compression, in the third week the fourth ventricle was punctured, and the patient recovered.   But was it really a case of tuberculosis?

I think it would be useless to repeat here the various remarks published relative to similar punctures and decompressive evacuations, and besides it would take too long.

I will only mention the following fact: Concetti,[39] having ascertained the uselessness of the lumbar puncture from the therapeutic point of view, tried to use it with the object of

introducing directly into the cavity of the meninges certain medicines believed to be effective against the tuberculous process. After having drawn away from ten to twenty cubic centimeters of cerebro spinal liquid, without in any way displacing his needle, he injected by means of it into the arachnoid cavity from 5 to 8 cubic centimetres of iodoformed oil of almonds at 1 per cent., or from 5 to 10 grammes of an aqueous iodo iodurate solution (1-10-100). But without result, and he abandoned the practice.

I wish to mention also the attempts made by Prof. Rotgans,[40] " Experimentally it seems possible to irrigate the base of the brain. Injecting a warm solution of colored gelatine at any point of the subdural cavity of the cranium, above the tent of the cerebellum, one finds the gelatine over the whole extent of the arachnoid, as well at the base as at the surface of both hemispheres." Guided by this Professor Rotgans, in two cases of tuberculous meningitis, injected an iodoformed emulsion into the subdural cavity. It is true he found in his autopsies, the iodoform at the base, but the children, operated when already in coma, succumbed one or two days after the operation, which was without result.

Very interesting also is a case reported by Winkler and Rotgans[41] which I will summarize here:

"A little girl of eleven years, with chronic otitis; tuberculous bacilli were proved present in the pus. She was trepanned above the postero superior part of the temporal lobe for a left lateral epilepsy, starting from the angle of the mouth. Leaving the dura mater intact they drew out from a depth of about one centimetre a considerable quantity of seropurulent liquid, and injected in its place an equal quantity of iodoformed emulsion. Some weeks later and two or three times afterwards they repeated the same treatment through the skin at the level of the crown of the trepan. At first the result seemed favorable and the Jacksonian attacks ceased; but a year later she was in the psychiatric clinic, mad, with all four limbs contracted and amaurotic through papillary atrophy. She died completely mad in November 1899. At the autopsy they found tuberculous meningitis of the base with very acute internal hydrocephalia.

Intraventricular injection is therefore possible and even with an immediate amelioration.

Of the same kind are the experimental labors of Nan-

notti [42] in the treatment of meningites.   After having pro-
voked several forms of meningitis in dogs he tried treating
them with subdural injections of sublimate.   And he obtained
excellent results in the forms of tuberculous meningitis, while
in the forms of acute suppurative meningitis he had none at
all.   He concludes therefore that tuberculous meningitis (at
least that which is obtained by experiment in dogs) is sus-
ceptible of cure by his method; that the cure may be obtained
even if the treatment takes place in the most advanced stages
of the disease; that the process of cure of tuberculosis of the
meninges has many points of contact with that of peritoneal
tuberculosis, studied both by the author himself and by others.

After these results, he proposes to apply the treatment of
subdural injections of sublimate to man.

However, as far as I know, the application has not been
yet tried.

Taking into account the essential difference of tubercu-
lous lesions obtained experimentally and of the resistance of
the dog, these results have still a considerable value.

Chipault [43] recalls cases of tuberculosis of the vault of
the cranium, complicated by meningo-encephalic lesions, of
which the typical form is the perforating tuberculosis with
hour-glass collection in two parts, the one extra, the other
intracranial: and reporting certain cases of it, he mentions
having observed some himself.   The case observed by Guar-
neri seems to have resembled this type.

Chipault [44] reports also a very interesting case of primitive
tuberculosis of the diploé, with perforation of the internal
and cortical phenomena; it seems however that lesions of the
meninges were wanting.   It is very seldom we have had more
active interventions, and they have always been negative in
their results.   Attempts of this nature have been reported by
Romme.[45]   Chipault   quotes a case   from   Masbrenier[46] in
which through erroneous diagnosis, intervention was made
above the vault.   Trevelyan quotes other interventions prac-
tised with the same object by Lannelongue and Keen,[47] by
Ord   and   Waterhouse,[48]   by   Parkin,[49]   Paget,[50]   Kendal
Franks,[51] and others; he reports one equally doubtful of Mayo
Robson [52] at the Leeds Infirmary.

TUBERCLES OF THE CEREBRUM OPERATED.

	OPERATOR	YEAR OF PUBLICATION	AGE AND SEX	SEAT AND VOLUME OF TUBERCLE	RESULTS	
					IMMEDIATE	LATER
1	MacEwen (?)	1885	Male, 36 years.... (Duret erroneously notes female 7 years).	Plaques of meningitis and encephalitis circumscribed (tuberculous?) on the ascending frontal (a small nut).	Cure	Continued 8 months later.
2	Horsley	1887	Male, 22.........	Tubercle of the third middle inferior of the ascending convolutions (ball of the thumb) 2 mm.	Cure	Six years after, vertebral tuberculosis; 18 months after, epydidymitis and tuberculous nephritis. Dead.
3	MacEwen	1888	Female, 7......... (Duret—Male, 37)	Subcortical tubercle in the upper part of the ascending convolutions (little nut).	Cure	
4	Knapp and Bradford	1889	Male, 32..........	Subcortical tubercle in the posterior portion, middle third of the Rolandic region (weight, 35¼ grams).	Death after ¾ hr.	
5	Mercanton and Combe	1889	Female, 12.........	Solitary tubercle in the middle part of the ascending frontal convolution.	Cure	Death 4 or 5 months after the operation. At the autopsy, 4 tubercles were found at different points of the cerebrum and cerebellum.
6	Booth and Curtis	1893	Male, 35...........	Hour-glass tubercle in the frontal region (weight, 20–25 grams).	Cure	Death within two months, from relapse. Multiple.
7	Winkler and Guldenarm (?)	1893	Male, 19..........	Calcified tumor on the anterior central (healed tumor?) 2½ cm.—1½ cm. Weight, 12 grams.	Cure	Sudden death 2½ years after.
8	Czerny	1894	Male, 23..........	Tubercle of frontal region. As large as a fist (weight, 205 grams).	Cure	Re-operated for tuberculous meningitis, and died 4 years after.
9	Schwartz	1894	Male, 33..........	Tubercle of Rolandic region (centre of superior member). As large as a nut. 6×2 cm.	Cure	Death from tuberculous meningo-encephalitis 1½ months later.
10	Krönlein.......	1895	Male, 43..........	Tuberculome in the inferior part of Rolandic region. As large as a hen's egg.	Cure	Still living and in fairly good health in 1901.
11	Tassl.	1895	Female............	Tubercle in the frontal region (hazel nut).	Cure	
12	Broca	1896	Male, 35..........	Tubercle in the middle third of the ascending frontal and foot of the second frontal; partial removal with the spoon.	Ameliora-tion	Death some months after.
13	De Paoli.......	1897	Female, 18.........	Tuberculome of the right motor zone.	Nil........	
14	Sick...........	1897	Female, 24.........	Solitary tubercle like a hazel nut, behind the central posterior circonvolutions.	Cure	Death at the end of 5 months.
15	Schnitzler.....	1898		Tuberculome of the right precentral circonvolution.	Died after 26 hours	

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TUBERCLES OF THE CEREBRUM OPERATED—(Continued).

	OPERATORS	YEAR OF PUBLICATION	AGE AND SEX	SEAT AND VOLUME OF TUBERCLE	RESULTS	
					IMMEDIATE	LATER
16	Heidenhain[1]	1889	Male, 29	Solitary tubercle, subcortical, of the paracentral lobule (size of a small hazel nut).	Cure	Continuing 2 years after.
17	Roux	1900	Female, 7½	Tuberculome of the Rolandic region (size of a mandarin orange). 4.5×5 cm.	Cure	Continuing 2 years, 10 months after.
18	Roux	1900	Male, 38	Tuberculome of the Rolandic region—ascending parietal (size, pigeon's egg).	Cure	Lasting 5 months after.
19	Lunz	1903	Female, 22	Tubercle of the Rolandic region (size of a nut).	Cure	
20	Durante	1903	Male, 23	Tubercle of the third superior of the ascending parietal and of the anterior portion of the upper and lower parietal circonvolutions.	Cure	Death at the end of three months. At the autopsy, multiple tubercles found in the right parietal and occipital lobes, in the sinus of the callous bodies, and in the great falx of the cerebrum: tuberculous leptomeningitis.
21	Tuffier	1903	Male, 29	Plaque of tubercular méningo-encephalitis in the left Rolandic region.	Cure	
22	Alessandri	1904	Male, 31	Tuberculome of the Rolandic region—third superior (size of a small nut). 5×2½ cm.	Cure	Continuing (July, 1905).

TUBERCLES OF THE CEREBELLUM OPERATED.

	OPERATORS	YEAR OF PUBLICATION	AGE AND SEX	SEAT AND VOLUME OF TUBERCLE	RESULTS	
					IMMEDIATE	LATER
1	Bennet	1887	Male, 7	Tubercle of the right hemisphere (pigeon's egg).	Death	From shock after 4 hours.
2	Horsley	1887	Male, 18	Tubercle of right hemisphere (weight, 7 grams).	Death	19 hours after.
3	MacEwen	1893	Male	Two tubercles of the cerebellum (one the size of a nut, the other smaller).	Cure	Died 10 months after, through relapse.
4	Parry	1893	Male, 5½	Tuberculome in left hemisphere. Incomplete removal with spoon.	Death	From hemorrhage or shock some hours after.
5	Lampiasi	1895	Male, 45	Tubercle of the left hemisphere (size of a chestnut).	Death	Of shock at the end of 15 hours.
6	Collins and Brewer	1897	Male, 26	Tuberculome of right hemisphere (diameter about 2 cm.). Removal in 3 fragments by spoon.	Cure	Died 2½ months after.

Published by Bayerthal, Mun. Med. Woch., 1899, No. 46. Afterward communicated by Heidenhain himself to the German Congress, 1901.

In Italy I only find five cases of interventions in tuberculous meningitis registered. They are those of Raffa,[53] of Guarneri,[54] of Codrilla[55] and two of Caselli.[56] In these two last there was a mere supposition of tuberculous meningitis, but on operating nothing was found. Those of Raffa and Guarneri are published in the report read by Roncali before the Twelfth Congress of the Italian Society of Surgery (1897), the others are reported in the collection of Chipault. In the case of Caselli the operation did not confirm the diagnosis; the case of Guarneri may be classed with those of cranial lesions with diffusion to the contents. The result was negative in all these cases.

I have myself [57] lately operated a child whose lesions led me to believe there had been a tuberculous meningitis, limited and healed.

The child was an orphan of eleven years. All hereditary syphilis was excluded; the mother died of chest complaint. There is a sister affected with ordinary epilepsy.

He had always been well until three years ago, when he began to suffer from convulsive attacks of clonicotonic type; these attacks begin in the muscles of the left hand, spread then through the whole arm, the face and the leg on the same side. It is impossible to give precise data as to the beginning of the affection; it commenced, it seems with fever and general cerebral symptoms; it is certain that all at once the attacks became more frequent, and after some time again more rare. While he was at the hospital they were repeated at irregular intervals of a few days, of a month, and even more, generally two or more attacks in the same day, the duration was always of a few minutes, without loss of consciousness; no emission of fecal matters, nor of urine; the patient did not foam, nor bite his tongue. The attack always commenced in the upper left member, spread sometimes to the face, at others to the leg, but always on the left side. It is to be noted that the attacks are generally preceded and followed by an increase of temperature (even to 38° degrees) which ceases by lysis. The objective examination presents nothing abnormal; only the muscular force of the right arm gives 25, that of the left 14. Otherwise, nothing as to mobility nor sensibility nor of the organs of the specific senses.

Operated by craniectomy; on the middle part of the right rolandic zone we found the dura mater thickened and resisting irregularly for an extension of about four by five centimetres; adhesions partly light, partly fibrous, to the soft meninges and cortical substance, especially visible along the vessels, and echelonned in nodular form in the two paracentral circonvolutions (middle part). We detached the adhesions, putting iodoform gauze in the wound on account of the fairly considerable hemorrhage, with partial suture of the dura mater, and replacing of the flap.

Healing per primam with quite normal course. On the eleventh day, a very slight attack, lasting a minute and limited to the arm and left side of face. After that, condition normal.

Although there is no diagnostic certainty, the age, the anamnesis, the lesions found on operating and above all the disposition of the adhesions along the vessels make me think that probably they were the results of tuberculous meningitis spontaneously cured.

In conclusion of what concerns the first part of my report, we must agree that, in the greater number of tuberculous processes of the meninges, above all in cases that run their course with the usual forms, surgical intervention is not to be advised, and the few cases in which it has been tried have not had success.

The different operations with decompressive scope have for the most part only a temporary value. The simple lumbar puncture has been up to now the operation preferred, on account also of its high diagnostic value. In some rare forms of meningitis in plaques, of meningitis of chronic course with localisations prevalent upon the meningian vault, or in the consequences of a localised and healed tuberculosis of the meninges we can speak of active surgical intervention. Those cases, besides, may, up to a certain point be classed among the lesions I am going to describe in the second part of my report.

Although we cannot repose with too much confidence upon the results of intervention in such cases, we must not either reject it a priori; the progress obtained in the domain of surgery exists to prove to us that, very often, successes have been obtained which theoretically seemed impossible.

Of Surgical intervention in the solitary tubercle of the brain.—When the tuberculous lesion does not take the ordinary form of a more or less diffuse meningo-encephalitis, we have what is called " solitary tubercle" whose form is generally almost spheroidal. This lesion is almost called Tuberculous Gumma, or tuberculous conglomerate, and its clinical physiognomy causes it to be classed among cerebral tumors.

Generally this type of tuberculous lesion does not affect the dura-meninge; on the contrary it attacks the pia mater at the same time as the cerebral substance in which it is embedded. It is not rare either to find it quite subcortical, without any relation with the meninges from which it is entirely removed (oval centre).

From statistics the frequency with which we find solitary tubercles in the brain is very great, above all in children. But, age apart, two other conditions are of the highest importance for the subject in hand: the part of the brain which is the seat of the tubercle and the unity or multiplicity of this last. With regard to frequency in general the statistics furnished by Allen Starr,[58] quoted in all treatises, gives out of 600 cases of cerebral tumors examined on the anatomical table, 193 solitary tubercle while the sarcomæ and gliomæ, though they are the neoplasms of most frequent occurrence are respectively only 120 and 91. The statistics of Birsch Hirschfeld[59] give 132 tubercles in 342 tumors, those of Hale White[60] 45 in 100. Durante[61] combining the statistical data of Starr, Seydel, Bernhardt, White and Birsch-Hirschfeld, in a total of 1633 cases of endocranial tumors, gives 489 tuberculosis to 414 sarcomata, 253 gliomata, and a smaller number of other less frequent varieties.

With regard to age, in 125 cases of tuberculosis in children, Simmonds[62] gives 16 solitary tubercles (12.8 per cent.), Schwer[63] 21 in 96 (21.9 per cent.); Boltz[64] 18 in 161 (11 per cent.); altogether 55 solitary tubercles in 382 cases of tuberculosis (14.4 per cent. and 2.1 per cent. for all autopsies). Hamann[65] at the Anatomo Pathological Institute of Kiel, found, in five years, among adults, 15 cases of solitary tubercles, equivalent to only 4.3 per cent. of the cases of tuberculosis. Plambeck,[66] in ten years, found still less, 9 cases

(1.8 per cent.) ; altogether among adults, in fifteen years, the cases of solitary tubercles represent only 3.1 per cent. of the cases of tuberculosis, and 0.7 per cent of the total autopsies.

So, among children, the frequency would be about four times greater than among adults. According to Starr, of 193 cases collected by him 152 referred to individuals below twenty years and 41 cases only to adults.

The report as to other tumors also has its importance. While among individuals below twenty years we have 37 gliomata and 34 sarcomata; above twenty years in comparison with only 41 tubercles, we have 54 gliomata, 86 sarcomata and 25 gliosarcomata. With regard to tuberculosis of the meninges, in 161 cases Boltz found it 64 times against 18 cases of solitary tubercle; Schwer observed 83 meningites and 21 solitary tubercles. In the 490 cases of Plambeck, 62 times, that is to say in 12.6 per cent. there was tuberculosis of the meninges, while the solitary tubercle only represented 1.8 per cent. Hamann, in 346 cases, found 15 solitary tubercles (4.3 per cent.) and 37 tuberculous meningites (10.7 per cent.).

But a still more important fact is that the tuberculous meningitis coexists often with the tubercle. In Boltz's 18 cases, 15 showed also tuberculous meningitis. Nothnagel [67] also remarks that the association of a solitary tubercle and of a tuberculous meningitis is a very frequent fact: in 16 cases of solitary tubercles, Simmonds found tuberculous meningitis in association with it ten times. In Eulenberg's [68] statistics, in 148 cases, 38 times there was coexistence of meningitis. Trevelyan [69] reports 33 cases of solitary tubercle in 114; and of these 33 there were 23 with meningitis.

In consequence, we may say, that, especially in children, in about 73 per cent. of the cases the solitary tubercle is associated with the tuberculous meningitis that is to say three or four times oftener than it is found isolated.

With respect to the regions of the brain attacked, Allen Starr's statistics give the greatest frequency in the cerebral axis (70), above all in the pons, in the ganglia of the base, in the quadrigeminal tubercles and in the peduncles, after that in the cerebellum (55) while in the cerebral cortex and in the

oval centre they give only 22 and 8 respectively. The figures in Eulenberg's Encyclopedia give 66 cases in the cerebral axis (especially in the pons, in corpora striata, and the optic layers) 55 in the cerebellum, and 51 in the cortex. A second set of statistics gives in 108 cases of solitary tubercle, 36 in the cerebellum, 34 in the cerebral axis and 7 in the cortex. Nothnagel and Gerhardt [70] also give the cerebellum as the seat preferred, in Trevelyan's cases the order of frequency is the cerebellum, the pons, the peduncles, and then the cortex. Another very important fact for us is the frequency with which, despite its name, the solitary tubercle is multiple. In Allen Starr's statistics which we have already quoted many times, multiple tuberculomes are noted 34 times in 152 cases under twenty years, and 4 times (in 41 cases) in adults. In Eulenberg's statistics in 148 cases, 67 are really solitary tubercles, while 81 cases were multiple. In the 33 cases reported by Trevelyan 17 were multiple. In general we find 2, 3, sometimes 4; but there are other cases in which we meet with many more. Homen,[71] West,[72] Hensch [73] mention 12, Middleton [74] found as many as 24, whose size varied from that of a pea to that of a hazel nut, and which were scattered in the grey substance of the frontal, parietal and occipital lobes and in the cerebellum, and it is to be noted that there were no symptoms during life.

From all that precedes certain points have been determined, which are of capital importance for the subject of surgical intervention.

The most frequent occurrence is in children; compared with other varieties it is the tubercle that is in their case the commonest cerebral tumor. It is also in the child that we most frequently meet the multiple tubercle, very frequently accompanied by more or less diffuse meningitis.

In adults, on the contrary, it is relatively rarer and, besides, very often single and without complications.

Further in children, as in adults, the seat of the tubercles, simple or not, is often in difficultly accessible regions of the brain.

Apart from what precedes we have to consider also the two other following facts:

(*a*) The coexistence in the organism of other tuberculous lesions whose presence counterindicates any intervention.

(*b*) The possibility of a spontaneous healing without surgical aid.

(*a*) As to the first point it is well known that the ordinary tuberculoses of the meninges are nearly always secondary to other foci in the organism.   We find oftenest tuberculous lesions, whether old or recent, in the glands, above all the peribronchial and mesenteric, in the lungs, sometimes in other viscera, in the bones, the joints, etc.

One may also have a diffusion of the tuberculous process through continuity (caries of the bones of the cranium, lesions of the nasopharynx, of the middle ear, etc.).   According to Heller,[75] one can never have, especially in children, a direct infection through the lymphatic vessels by the nasal cavities (primitive cases?).   In 44 observations on solitary tubercles, Hale White reports that there have always been other localisations of tuberculosis in the organism; only in 5 cases, was a single organ attacked and in 4 two were attacked; in the other cases, 3, 4, 5 organs or apparatuses were affected, and even more sometimes.   In Trevelyan's 114 cases, only six showed no other foci; but the autopsies were incomplete.

Evidently in the case of generalised tuberculosis or of very diffuse and advanced tuberculous lesion—even of a single apparatus (respiratory, digestive, etc), it is vain to think of surgical intervention for the cerebral lesion, which, in such cases, passes into the second line.   Of the 9 cases, out of Hale White's 45, cited above, that had limited foci in the other parts of the organism 1 case had multiple tubercle; in another the seat of the tuberculome was the pons.   Of the other 7, one was accompanied by meningitis of the base, 3 were very diffuse.

We must recognize that these statistics are very discouraging.

(*b*) The possibility of healing of solitary tubercles is nowadays strengthened by many observations, and many researches have been made as to the manner in which this healing is effected.

The tuberculous conglomerate, really a mass of miliary

tubercles, can, on developing, attain a size varying generally between that of a green pea and that of a pigeon's egg. Some even larger have been reported. Jackson says he found one as large as a billiard ball in the cerebellum of a child of five years; Arnot found four as large as a hen's egg in the cerebrum of a child of four years and a half; Nothnagel, as large as a duck's egg, Trevelyan as large as an orange and even larger. The one Czerny extirpated weighed 205 grammes, that of Knapp and Bradford 63, that of Krönlein was as large as a fowl's egg, those of Roux and Terrier as large as mandarin oranges. Durante mentions two in the same individual, of which one weighed 30 grammes, the other 40; the one I extirpated myself was as large as a little nut.

The cheesy degeneration, above all in the centre, is ordinarily very early and its limitation by cerebral substance is also more or less definite; we often find all round a certain extension of hyperæmia and vascular development or a zone of tissue of granulations which can be sometimes transformed into a real capsule of compact fibrous tissue. In this case it is evident there is a tendency to incapsulation and sometimes to calcification which leads to a cure.

Treyer [76] reminds us that Wernicke, Gowers, Knapp, Starr, Baginsky, Sternberg, Sahli and others report cures of this class; and the greater part took place after treatment with strong doses of potassium iodide. Bruns equally affirms, that Gowers obtained cures with potassium iodide, codliver oil, iron, country air, etc.

Certainly, in such cases cure is notwithstanding always relative, and we must before all things exclude a syphilitic lesion.

In two cases he reports, Trevelyan found a fibrous centre and a calcareous mass that one might consider as healed tubercles. In one case Williamson [77] met with a little yellowish mass; in another, Ashby [78] found a little cyst with earthy walls; Bristowe,[79] in a third case, a hard mass in the cerebellum. In all three cases there was death from tuberculosis and afterwards other tuberculous masses were found in the brain. In a case reported by Kahlmeyer[80] there was a scar with yellowish striæ in the cerebellum of a woman who eleven

years before, had presented phenomena of disease of cerebellum; the woman was consumptive; there was no syphilis. Oppenheim [81] reports the case of Siemon, in which the autopsy discovered in the brain an old tubercle, at first caseified, and afterwards ossified. When alive, the individual was hemiplegic and an idiot. Winkler [82] presents a case operated by Guldenarm, in which he found in the central circonvolutions, where he extirpated it, a calcified tumor of strange form, like a segment of a sphere whose chord would be $3\frac{1}{2}$ centimetres. Its weight was twelve grammes and a membrane prolonging itself across the cortex put it in communication with the pia mater. After having decalcified it they found it enveloped by two membranes one thick and of connective tissue, the other of granulation tissue. These two membranes covered a centre formed of calcified detritus. The case mentioned by Foa [83] is also very important. He found in the cerebellum a nodus of fibrous, almost tendinous aspect, with irregular edges; in the centre two little yellowish foci, thick, of cheesy appearance: there were also lesions of the dura mater and of the soft meninges, demonstrating an old meningitis cured.

From what precedes we can then consider some cases as certain; others on the contrary are very doubtful and we can hardly speak of true cure; without considering that for the brain and especially for certain regions of this last, as we shall see further on, the tubercles even if they become incapsulated or are calcified always represent a lesion with grave functional symptoms. The mode of healing is rather a question of pathological histology, and although interesting, to be shorter, I shall speak of it in passing. I will mention, however, the interesting experimental researches of Barbacci [64]: He, in the struggle against bacilli, attaches the greatest importance to the fixed elements but especially to the mobile elements, first the polynucleated, then the mononucleated and to the calcification of the focus. Let me notice also the observations of Roncali [65] on the case operated upon by Durante. These observations support the possibility of a connective fibrous transformation. This commences, it seems, in the central part of the nodus, particularly under the action of the elements of immigration around tubercles which are evidently in course of involution.

In one case which I myself operated, I remarked rather a tendency to capsulation of the process by development of a connective fibrillous tissue at the periphery of the tumor, this tissue was, at certain points of adult fibrous type; this connective neoformation was not uniformly developed at all points; in the inferior section of the tuberculome, it was not clearly limited by the cerebral substance, one even saw histologically the gradual passage of the typical tuberculous granulation into the nervous tissue, accompanied by abundant parvicellular infiltration.

The results I have attempted to put together up to now lead us to the following conclusion: there can be a question of surgical intervention in only a small number of cases even when it is a matter of limited tuberculous lesions of the brain.

And this by reason of, specially, the ordinary site of the tubercles, the frequent complication with meningitis, their multiplicity, the presence of other serious tuberculous lesions in other organs of the body.

Relative to intervention the possibility of spontaneous healing has an importance which varies according to the point of view under which we consider it. In effect, if in some inaccessible regions and in case of multiplicity of tubercles, the possibility of healing has to be thought of for medical treatment, surgical intervention can not be excluded for the regions where it is possible, since a tuberculous conglomerate may occasion very serious functional derangements even if this conglomerate is capsulated and stationary. More, it may encourage to surgical action even in the possible hypothesis of other similar cerebral foci, in other silent seats.

In any case to allow of intervention the essential point is that we can diagnose with precision the seat of the lesion, and it goes without saying that this must be surgically accessible.

What precedes concerns as much the tubercle as any other cerebral tumor, and the question being well known and very common it need not delay us in our special report. Several authors have related cases of tubercles of the pons, of the quadrigeminal corpora, of the cerebral peduncles, in which symptomatology allowed the seat of the lesion to be deter-

mined, but in which there was evidently no possibility of surgical action.

It is evident that in this connection possibility of establishing exactly the seat of the lesion will present itself first to the Rolandic region; secondly and in a few cases for the tubercles of the cerebellum, for the frontal lobes, sometimes for the occipital and sphenotemporal (visual and auditory centres). It is often even much more difficult to determine if the lesion is meningeal, cortical or deep seated. For the psychomotor centres themselves the presence or the absence of epileptiform attacks accompanied, or not, by persistent pareses and their clonic or tonic character are not sufficient to allow us to diagnose the seat of the process in the meninges or in the cortex. So also in the case of cephalalgia and local heat mentioned by some. Cranial percussion both in its timbre and in the pain it causes is without gainsaying very important; MacEwen and Bruns insist on this. De Paoli[87] has made important researches with regard to this subject. Durante has proved its value in many cases; but it is not always certain. In my case, for example, the percussion and the pain led to the probable diagnosis of a lesion of the meninges while the dura mater was perfectly normal, not adherent, and the cortical focus rather deep.

When we have established the seat of an organic lesion and this seat is accessible with regard to our subject we could here put two questions:

1.—Is it possible also to diagnose the nature?

2.—And if we diagnose tuberculous tumor would that dissuade us from intervention?

In general diagnosis of nature is always very difficult.

In the particular case of tuberculosis, apart from the age, the hereditary antecedents, and the general constitution of the subject (data always uncertain) an important argument is from the presence of other tuberculous foci in the organism: most often in the lungs, in the lymphatic ganglia, in the bones or articulations.

Several consider the examination of the ocular cavity (tubercles in the choroid) as decisive: now since the positive discovery has for its special characteristic a meningitic dif-

fusion, it is evident on this account that this discovery cannot have place in the typical cases of solitary tubercule, which are just the cases susceptible of surgical operation and one cannot have the discovery of a simple papilla of stasis (especially in circumscribed lesions) or, if it exists, it indicates nothing except an endocranial compression, whose nature it does not inform us of.

Increases of temperature at sunset, above all if coincident with the attacks, may on the contrary give us a probability. It goes without saying that we should not be able to attribute them to other causes or to other foci existing in the organism.

The same thing may be said of the injection of tuberculin; it may indeed indicate to us tuberculosis in the organism, but the lesion may exist in other organs. See the communication of Dupont[88] to the International Congress of 1900.

The diagnosis of the nature cannot be made then, or it will be rested upon probability in a few cases.

That, however, does not exclude intervention. And before everything for the good reason that even if it were demonstrated that in presence of tubercles it is better not to intervene, the uncertainty of the diagnosis should not stop us in other processes in which, given the clear symptom, intervention may be useful.

In the second place because while taking into account all the difficulties and the data mentioned above, the majority admit to-day that the tubercle is susceptible of extirpation and of cure. And statistics confirm this.

Bergmann [89] himself who is considered opposed to intervention, says merely that he does not wish to enter into the question of operation or non-intervention in the case of tubercles, especially of those of the cerebellum, but adds when the operation shows there is a tuberculous tumor it must always be removed. Now as it is generally so (the diagnosis of nature being only possible approximatively), we can say we are all agreed upon the practical indication of intervention in cerebral tubercles, provided it is indicated by the following conditions: precise diagnosis of the seat, accessible region, absence of signs of multiple or diffuse lesions, general satisfactory condition of the subject.

It is not my part here to enter into technical details which do not differ from those in the case of cerebral tumors generally.

Oftenest, the tuberculome can be removed easily thanks to the sufficiently exact limitation one finds in the greatest number of cases: we have often succeeded in extirpating them with a blunt instrument, or with the finger; seldom with the sharp knife or the spoon.

I will rather report the statistic data important for our purpose, since they teach us what has been done up to date, as well as the results obtained; they may also encourage us to greater boldness and to better hopes.

In the statistics I only include cases in which the tubercle was found on operation and removed.

The first sets of statistics of Chipault [90] and Bergmann [91] report respectively 9 cases, the first, and 8, the second, for the cerebrum and 3 and 4 for the cerebellum.

Auvray [92] adds another case.

Treyer [93] when repeating them summarized the cases already published and added two new ones from Roux.

So, altogether, deducting the operations unsuccessful or palliative, he has put together 16 cases of operations upon solitary tubercles in the brain (12 in the cerebrum and 4 in the cerebellum).

In one case however (obs. xi of Macewen) it is very doubtful if it was tuberculosis.   He reports, besides, 10 cases where the intervention was ineffectual whilst the autopsy showed one or even several tubercles whose position varied. Amongst these last, one of the cerebellum (Parry's case) must be included in the first series because the tubercle was partially removed.

There were then 12 cases operated for the cerebrum, and 5 for the cerebellum.   Krönlein [94] at the Thirtieth Congress of the German Surgical Society (April 1901) reporting on the man operated by him in 1895 who was still living, repeated Treyer's statistics.

Duret [95] reports 16 cases of the brain but, amongst them, he includes the case of Andrenoud, in which nothing was found at the operation.

Of the other 15, 12 were already reported in the preceding statistics; the three new ones are the cases of Bayerthal, of Lunz and Heidenhain. But Bayerthal's case and Heidenhain's are the same, the case was operated by Heidenhain and published by Bayerthal, his assistant; afterwards Heidenhain himself communicated it to the German Congress of Surgery.

There are then really 14 cases.

On the other hand, he omits the two cases reported by Sick [96] and Schnitzler,[97] which make 16 cases.

For the cerebellum he reports 7, of which 3 are already included in Treyer's statistics, and that of Parry, reported by Treyer erroneously among the unfruitful operations; but we must subtract Terrier's case, reported even by Treyer, and the other two of Jaboulay and Descot, and of Okynzic-Tuffier, in which the tuberculous tumor was not found in the operation. On the contrary I think the case of Tuffier I reported in the first part of the report can be included in the statistics.

To resume there have been 17 cases of the cerebrum and 4 of the cerebellum. To these we must add the case of Collins and Brewer, reported by Treyer.

Further we may report the Italian statistics. In Italy 6 interventions for tubercles of the cerebrum and 3 for the cerebellum have been published. The cerebral interventions are those of Tassi,[98] Poli,[99] De Paoli, [100] Bendandi,[101] Durante [102] and Alessandri,[103] those of the cerebellum are those of Lampiasi [104-105] and Nota.[106]

I résumé here the results:—In operating, the tuberculous lesion was not found either in the case of Poli (it was in the left cerebral peduncle), nor in the case of Bendandi, (two tubercles at the external and posterior part of the third temporal of both sides). Amongst the cerebellous tubercles, the first case of Lampiasi is that which Treyer and others report very inaccurately; the tumor was not discovered at the operation. In the second case, on the contrary, the tumor was found and extirpated. In Nota's case the operation was also unfruitful.

We must then only add to the statistics above given 4 cases of cerebral tuberculosis and 1 of tuberculosis of the cerebellum. In all, 22 cases of operation for the cerebrum and 6

for the cerebellum.   In his last collection Chipault [107] men-
tions two other cases in which he only made some quite simple
decompressive trepannings without finding the tumor which
was discovered at the autopsy, in one of the cases they found a
tubercle in each of the hemispheres of the cerebellum, and in
the other they discovered a large plaque of cheesy meningitis
in the right frontal region.   It is also necessary to mention in
passing, without including it in our statistics, the case of Fison
and Luckham,[108] that is to say of a young man of 16, in which
death took place before the end of the trepanning; at the
autopsy a tubercle was found in the left lobe of the cere-
bellum.

I think on the contrary that it is necessary to add to the
statistics the case of Winkler and Guldenarm mentioned above.

So that the cases operated, in which on operation the
tuberculous lesion was discovered and removed either entirely
or partially are 21 for the cerebrum and 6 for the cerebellum.

See in the tables (pp. 169 and 170) their most important
details.

In conclusion, given the limitations to indication for
operating I have spoken of above, the results are fairly good
for the cerebrum.   In 22 cases operated the result of the
operation was favorable in 19; it is true we must add that,
in some of these cases, the amelioration was very little or none
at all.   In several cases treated by surgical intervention, there
was death following more or less closely, whether through
multiple tubercules or through meningitic diffusion of the
process.   But in others the good result continued long enough
and has probably lasted.   We have in fact reports of the good
health of the patients operated by Macewen (after eight
months), by Horsley (after six years), by Czerny (during
four years), by Krönlein (after six years), by Roux (after
about three years, and after five months), by Alessandri (now
after more than a year).

The statistics of tuberculoses of the cerebellum are, on the
contrary, more discouraging: in fact, in 6 cases in which we
have been able to find a lesion and to remove it by means of
the operation, 4 cases were immediately followed by death and
two others had only a transitory amelioration since death took
place after two months and a half in the one case and after

ten months in the most favorable case (Macewen). What precedes seems then to justify the idea of Bergmann who advises against intervention in cases of tuberculosis of the cerebellum.

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THE ELASTIC LIGATURE AND THE LIGATURE METHOD.[1]

HISTORICAL AND EXPERIMENTAL DATA FROM THE SURGICAL LABORATORY OF THE MEDICAL DEPARTMENT OF THE UNIVERSITY OF CALIFORNIA.

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THE paucity of accurate data concerning the history of the elastic ligature has prompted the present communication, in which the topic is also viewed from the standpoint of experimentation. No claim to originality is made, in view of the conceded threadbare condition of the subject to which the experiments relate: gastric and intestinal suture. To an Italian surgeon, Grandesso Silvestri, of Vicence, we owe the first published reference to and experimental study of the elastic ligature (1862). A year later, Richard, acting upon Prof. Trousseau's advice, used the elastic ligature in various cases, 17 in all (vascular growths, tumors of the breast, fistulæ in ano, etc.), and reported the results in a brief memoir (1863). Subsequently (1865) two English surgeons, Bryant and Henry Lee, resorted to this method for the removal of lipomata, hemorrhoids and pediculated growths, and in 1871 Henry Lee reported to the London Clinical Society an ablation of the tongue by means of the elastic ligature.

The same year Grandesso Silvestri published a second memoir on the subject, confirming and completing his original conclusions.

The above mentioned trials passed almost unnoticed. Hence Dittel's announcement of the discovery of the elastic ligature before the Medical Society of Vienna, 1873. His attention had been drawn to the possibilities of this method of treatment by the following very curious incident:

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On the 5th of March, 1872, a girl, aged 11 years, was admitted to the hospital for marked headache. Examination showed a suppurating wound encircling the entire head and containing an elastic cord which was forthwith removed. According to the patient's statement, she had often been severely punished by her mother-in-law for the untidy condition of her hair, and had sought long ago to avoid further chastisement by continuously wearing a net with an elastic cord stretched tightly around the head, thus preventing the displacement of the net. Symptoms of meningitis appeared at an early date, death occurring March 21st. The necropsy showed section of the soft parts and of the bones of the skull, as if made by a fine saw. With the exception of a few trabeculæ, the section of the cranium was complete.

Encouraged by this demonstration, Dittel immediately applied the elastic ligature in over 200 cases: Erectile tumors, anal fistulæ, ablation of cancer of the breast, ligation of vessels, prolapsus ani, phymosis, castration and amputation of the lower limb. Thus Dittel's contribution to the elastic ligature brought the method into prominence. Nevertheless, the priority belongs to Grandesso Silvestri. Even Dittel himself (Oct. 7, 1873), with very commendable loyalty, publicly acknowledged the justice of Silvestri's claims. Contemporary German writers, for reasons unknown, fail to mention the latter incident.

Grandesso Silvestri used the elastic ligature in lateral intestinal anastomosis, but, finding it unsatisfactory, discarded it immediately. Gaston of Atlanta (1884), was the first to employ the ligature method for the establishment of a channel of communication between hollow viscera. His cholecyst-duodenostomies by this method were not satisfactory, however, and Gaston voiced his preference for the suture method.

Shortly afterwards (1888) Bardenheuer reported a series of intestinal anastomoses with a round rubber cord, 1 to 1.5 mm. in diameter, forming a chain ligature. In 1891 McGraw published his first address on the elastic ligature, simplifying Bardenheuer's technique but retaining the latter's round rubber ligature material.

Although ably and adroitly presented, the cause of the elastic ligature failed to make converts, and was soon abandoned by its chief advocate.

Then followed a series of researches by Russian sur-

geons.　Podres (1898) used two silk ligatures in the shape of a cross, thus obtaining a star shaped opening within four days.　Podres applied this method in two patients.　The result in one case was excellent; the second patient died on the sixteenth day.　Sokoloff, using the same method, reported three gastro-enterostomies with two failures to cut out.

After several similar failures Podres modified his method by circumscribing a rectangular area 4x6 cm. by means of four silk ligatures traversing all the gastric and intestinal layers.　Schalita, Sokoloff, Varnex and Tedoroff (1899) reported numerous gastric anastomoses by this method, but the results failed to convince other Russian or the Continental surgeons.　Porta (1899) modified McGraw's technique by using a rubber band and Raffa further complicated the question with two elastic ligatures.　Modlinski (1899) substituted rubber for silk in Podres' method.　In 1892 Postnikow proposed an oval excision of the seromuscular layers of the stomach and intestine, followed by ligation of the protruding mucosa.*　Trojanoff (1893) and Lauenstein (1894) each reported a success in men with this method.　Mugnai, a year earlier, had used the thermocautery instead of the knife, prior to ligating the mucosa.

In 1901 McGraw reiterated his statements regarding the elastic ligature, and reported a series of successful trials with with what he calls " a method of my own invention " (N. Y. Med. Jour. 1901, p. 133).　While McGraw is in no sense the originator of the elastic ligature, he nevertheless deserves unstinted praise for having rejuvenated, made practical and ably advocated this very interesting question of operative technique.

ELASTIC LIGATURE.

Size of the Elastic Ligature.—While the round rubber ligature used by Bardenheuer measured only 1.5 mm. in diameter, that employed by McGraw measured 3 to 5 mm. Our experiments on large dogs, and seven cases in man, proved conclusively the superiority of a much smaller size.　The flat rubber bands 1 to 2 mm. in width, as are commonly found in

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* This procedure was recently recreated by R. C. Coffey, of Portland, Ore. (Medical News, Nov. 4, 1905.)

stationary stores, gave excellent results in intestinal anastomoses.

Quality of Rubber.—Pure rubber, capable of being stretched at least five times its length, should be selected.

The usual rectangular mode of placing the elastic ligature is the quickest and safest. All other methods make irregular and small cut-outs.

The plan of punching out a stoma originated with Bardenheuer (rubber-chain ligature). Podres sought to obtain the same effect by using silk ligature in triangles and squares.

Subsequently the problem received some attention from C. M. Cooper, of San Francisco, and later from Weir and Maury, of New York, who recently disinterred the old method of Podres, rendering it still more complicated. In view of studying the merits of the punching-out plan, a large number of intestinal anastomoses were made with rubber, silk and twine, enclosing areas of diverse shapes—squares, rectangles, Greek stars, single and double triangles. The results showed a high mortality whenever the simple rectangular method was departed from and the rubber openings were invariably the most satisfactory. All anastomotic openings eventually become oval or circular.

The mode of securing the knot suggested to McGraw by Hickey is, at best, a clumsy device. The more recent mode of tying the rubber with silk or thread is merely a modification of the procedure employed years ago by Sir Henry Thompson (1874). A simpler and equally safe method is to place a clamp on the rubber strands previously drawn taught; a silk ligature can then be placed beneath the clamp, the rubber cut short and the clamp removed without fear of the knot slipping.

In a series of over 150 operations, comprising 12 different interventions on the stomach, intestine, gall-bladder and urinary bladder, rubber cord, 3 mm. in diameter and flat rubber bands 1 to 2 mm. in width and 1 mm. in thickness were used, with the ordinary or the Reverdin needle.

The time necessary for the elastic ligature to cut through, varied considerably. However, with a fixed degree of constriction the time required for the cut-out is directly propor-

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tionate to the amount of tissue in the bight of the knot. This fact is well illustrated in Bardenheuer's method of gastro-enter-ostomy by elastic chain ligatures in which the cut-out takes place within two days.

The shortest time noted in any of the dogs was three days for the intestine and four days for the stomach. In the majority of dogs the cut-out took place in four days (stomach) and three days (intestine); in the early experiments, more time was required with cats (four to six days), but later the constriction was more properly made and the results resembled those obtained in dogs. Variations in the time of the cut-out may be partly due to the quality of rubber. Old or boiled rubber may lose much of its elasticity. The degree of con-striction is undoubtedly the principal and most important factor.

In estimating results, the intestine will be considered independently of the stomach.

Intestine.—The following sufficiently accurate mode of comparison was adopted:

1st, A series (5, 6, 7,) of lateral anastomoses were made at the same séance by the rectangular-ligature method with various materials,—rubber, silk, twine, plain and chromic gut, of various sizes.

2d, Several lateral anastomoses by the various suture methods,—the two-row suture, the continuous or interrupted Connell suture.

Necropsy specimens of a large series of these experiments show:

1st, A considerable number of failures to cut-out when No. 1 catgut and No. 1 silk are used.

2d, A few failures with linen thread of silk No. 2 and 3.

3d, No failure with properly placed rubber.

4th, In one instance the rubber (1x1 mm.) was found encysted, having evidently broken.

5th, The size and shape of the anastomotic opening were somewhat influenced by the nature of the ligature material. The opening produced by rubber exceeds all others in the transverse and longitudinal diameters.

6th, In *successful* intestinal anatomoses, the cut-out re-

quired more time with rubber than with any of the other materials, all of which could be handled more expeditiously and with a greater degree of immediate sero-serous approximation than rubber. The only somewhat bulky knot was that of rubber.

7th, The puckering of the gut produced by the ligature sometimes persists more than thirty days. This is particularly noticeable in intestinal anastomoses measuring more than 5 cm. In these cases the opening is seldom clean cut; on either side and in the middle third of the opening an elevated granulating fold will be frequently found as late as the fourteenth day.

This is more or less present at an early date in all methods of intestinal anastomosis. The elimination of the protruding parts between the two flaps of mucosa takes place by necrosis or by the destroying power of those crypts which have returned to their embryonic type (Mall).

8th, The stoma made with rubber can always be recognized; it is large, clean cut, and has a sharp, regular edge. The Connell stitch produces a much shorter and narrower stoma, owing to the constant presence of a bridge formed by the protruding intestinal layers. Regeneration of the mucosa is somewhat slower than with the elastic ligature.

9th, The classic two-row suture method makes a stoma comparing favorably in width and length with that made by rubber. It is, however, generally less regular in outline. Furthermore, regeneration of the mucosa requires more time, and omental adhesions are more pronounced than in both of the above methods of anastomosis.

No apparent contraction was noted in elastic ligature openings after a period of twelve and sixteen months.*

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* The observations of the Mayo Brothers regarding the closure of the anastomotic opening in cases of patulous pylorus were not substantiated in any of the dogs operated on and kept under observation for several months. Furthermore, the findings of the French, German and Swiss schools (Terrier, Hartmann, Montprofit, Kocher, Witzel and Roux) do not corroborate the Mayos' assertion. The occurrence of this complication in the Mayos' early cases suggests the presence of slight local peritonitis due to over-manipulation or possibly faulty suturing, causing an inordinate amount of granulation tissue.

The *modus operandi* of a successful anastomosis by the ligature method is conclusively illustrated by the inspection of the parts immediately after the operation. It will be noticed, first, on the peritoneal surface of the bowel, that the ligature material (silk or twine) has cut through the serous and mucous layer and the major portion of the muscular layers, leaving merely a few circular muscular fibres and some submucosa; second, on the mucous surface of the bowel, when the ligature fails to cut through the muscular layer, the submucosa retains its vascular supply, and consequently does not undergo necrosis. It would seem, therefore, that the bridges of tissue in the anastomotic opening, noted by all experimenters, are in part due to insufficient or irregular constriction of the parts involved. In other cases of totally inadequate constriction, the mucous surfaces show, after eight days, a lineal scar of variable depth, when catgut is used, or two minute orifices, surrounded by scar tissue, in which the silk or twine (rectangular) ligature hangs loosely.

In view of the immediate destruction of the various intestinal layers by the use of the ligature method (silk or twine), several attempts were made to obtain an anastomotic opening by removing the ligature and then circumscribing the entire previously ligated area with Lembert sutures. Failure followed in all cases. A certain amount of necrosis occurs, but a lineal cicatrix will be found as early as the sixth day. Microscopic sections of specimens of one hour, one and two days, proved conclusively the impossibility of securing anastomosis by this method. Mention is made of these negative results in view of the recent erroneous statements of Werelius (J. A. M. A., 1904).

Stomach.—Rubber cord, 2 or 3 mm. in diameter, placed in the usual rectangular manner, never failed to cut-out. In all cases inspected during the first and second days the pyloric end of the stomach seemed to be in a state of contraction. This condition was not present on the third day. Dilatation of the stomach was present in a few cases during the first and second days.

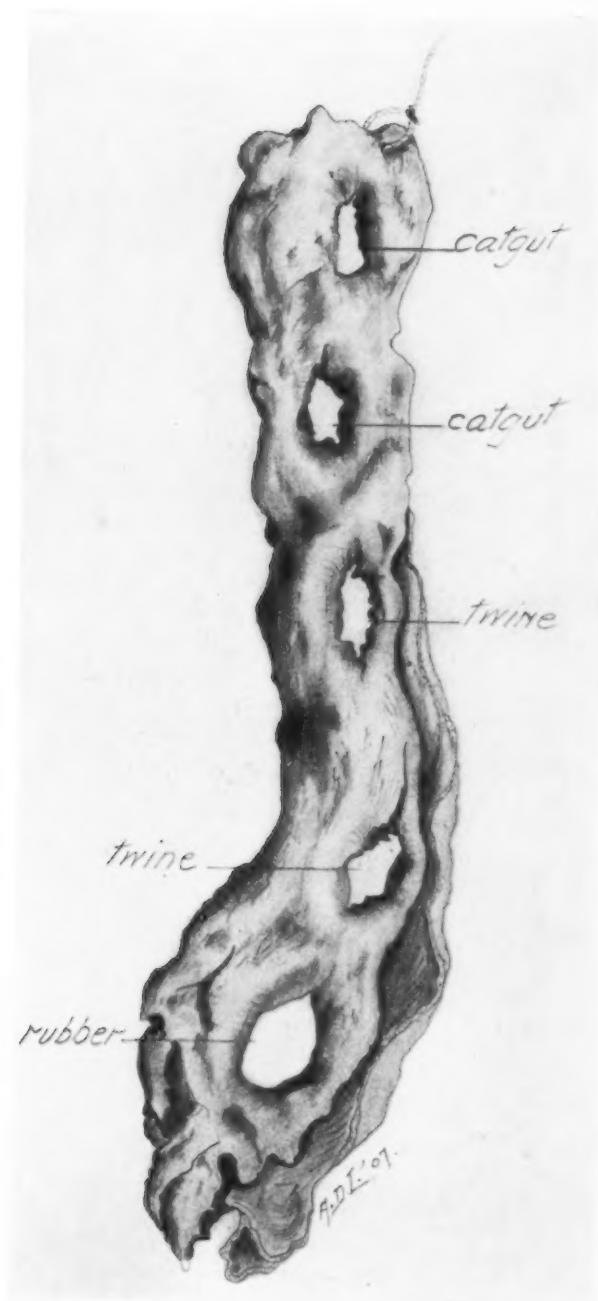For comparative purposes, ten dogs and six cats were sub-

FIG. 1.—Natural Size.
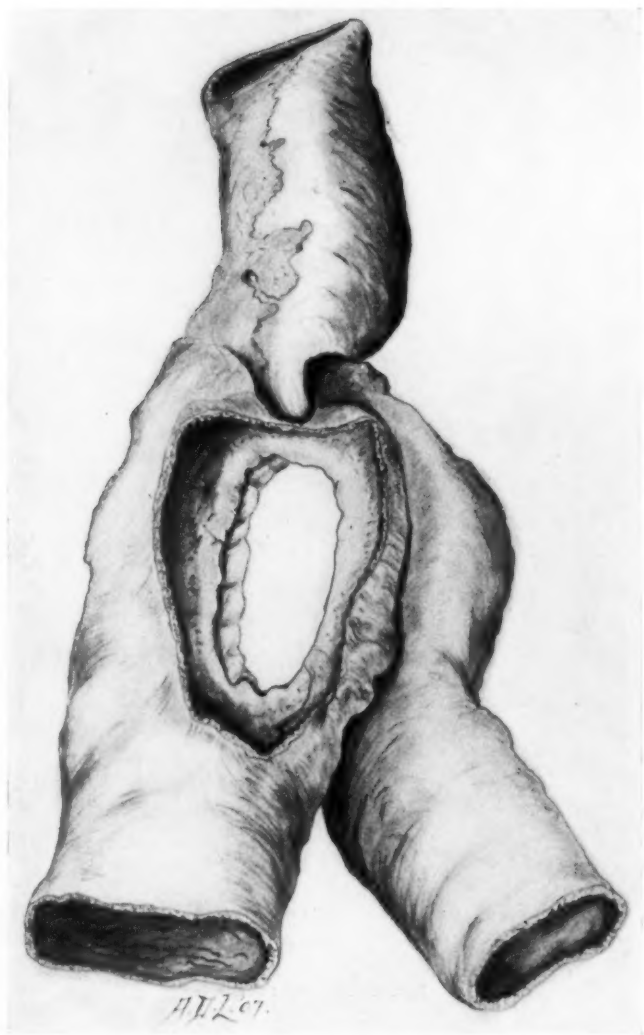
FIG. 2.—Natural Size.

FIG. 3.—Rubber—15 days.

FIG. 4.—Two-row Suture (10 days.)

jected to a gastroduodenostomy* (Villard, Kocher) and simul-
taneously to a posterior gastro-enterostomy. Rubber, in rec-
tangle, was used for one operation; and twine, in triangles,
for the other. The results were uniform. Aside from being
far less expeditious, twine in triangles proved less safe, more
bloody, necessitated more extensive sero-serous suturing,
caused more pronounced and more lasting kinking of the gut
and more irregularly shaped and no larger openings than the
elastic ligature used in the usual rectangular manner. Failure
to cut-out was occasionally noted with twine.

We feel, therefore, justified in condemning all attempts to
render difficult and dangerous a very simple and safe procedure.

In view of studying the degree of shock resulting from
the use of the ligature method, the following operations were
performed at one séance on a pregnant slut: 1 gastro-enter-
ostomy, and 2 entero-enterostomies. Evidence of pain during
the first 36 hours was the only noticeable feature;—the animal
ran about as usual on and after the third day, and gave
birth to five pups of normal size on the seventh day.

The following was done on a male dog: 1 cholecysto-
gastro-enterostomy, and 4 lateral anastomoses.

In a third case eight lateral anastomoses were made.
These dogs remained without food for two days, then gradu-
ally resumed their normal state and were subsequently re-
operated, in one case as many as six times. Anastomosis made
under local anesthesia caused very marked pain when twine
or silk was tied in triangles or squares. With rubber, in
rectangle, pain was much less apparent.†

Speed.—The ligature (intestinal) can be placed, tied
and cut within fifteen seconds, and an additional anterior sup-
porting mattress suture requires about the same length of time.

A series of over fifty ligature operations (catgut, silk)
show that protecting sutures are not indispensable in intestinal
anastomosis. Under these circumstances omental adhesions
were seldom noticed, and in cases of reoperation after thirty

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* Finney's operation can be done with the elastic ligature, but failures
are not infrequent.

† Halsted and Mall noticed that sero-serous union frequently took
place before the operation was completed.

days none was found. The posterior row of protecting sutures
is entirely superfluous in view of the perfect sero-serous approx-
imation, and the sole purpose of the anterior suture is to cover
an immoderately large knot. Microscopic sections show clearly
the advantages of protective sutures when rubber is used,
although they may be dispensed with, as proved by a long list
of successful gastric anastomoses in the dog. However, when
considerable tissue is included in the bight of the ligature sup-
porting sutures are in order. Under such circumstances a
posterior row and a single anterior mattress suture will prove
expeditious and thoroughly adequate.

These facts are rather significant when we recall Gregory
Connell's loud utterances relative to the "knot within the
bowel," a feature which made but little impression on experi-
enced American surgeons and none at all on foreign surgeons.
As early as 1889 Chaput proved the absence of ill results from
through and through intestinal sutures with the knot outside
of the bowel, and subsequently Sonnenberg advocated and
successfully practiced a similar method in appendicectomy.*

Convinced of the reliability of the results of experimental
findings in the question of supporting sutures, we made (Aug.,
1904) a lateral anastomosis in the pelvic colon in order to
circumvent the consequences of a kink following the resection
of a sarcoma of the bowel. Braided silk was used in the usual
rectangular mode, and a single narrow mattress catgut suture
sufficed to cover the knot. Immediate and final results were
perfect; no peritoneal reaction was noted. The patient passed
gas the first day and had a large formed evacuation of the
bowels the sixth day. Having eleven months previously made
a lateral anastomosis in this patient by the two-row suture
method, we were able to appreciate the simplicity of the ligature
method.

The claim that union by first intention occurs with the
elastic ligature in gastro-intestinal anastomosis is most easily
disproved by the very elementary consideration of pressure

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* It is not commonly known that the essential part of the so-called
Connell suture—the through and through continuous stitch—is due to
M. E. Connell (1888). Gregory Connell modified his father's suture by
placing the knot within the lumen of the gut.
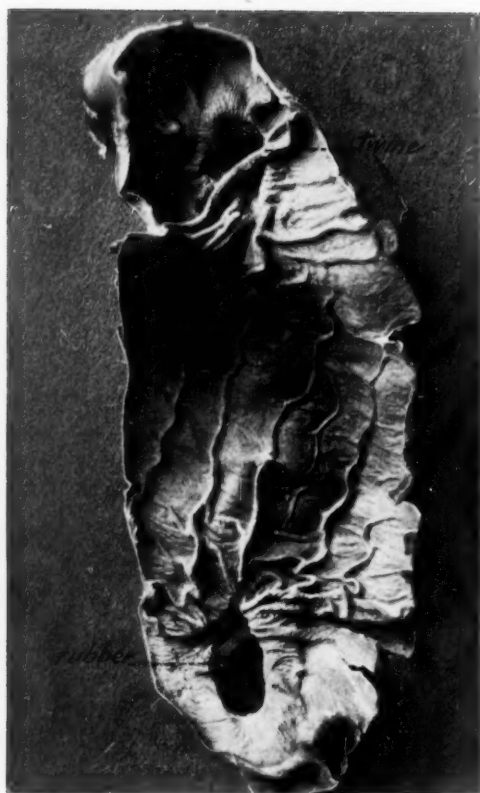
FIG. 5.—Twine (rectangular).

FIG. 6.—Gastro-duodenostomy and Gastro-enterostomy.

necrosis in a septic medium like the intestinal canal.   Further-
more, microscopic sections of ligature specimens of two to
three   weeks, frequently show a marked gap of granulation
tissue between the gastric and intestinal epithelial borders.

Again, it is stated that there is no escape of feces and
therefore no exposure to peritoneal infection from the bowel
contents.   Inspection of the portion of the ligature which has
traversed the bowel will invariably show the presence of feces
in the unprepared cases, and culture tubes inoculated with the
rubber in question always give a luxuriant growth of bacteria
in the prepared cases.   It may, therefore, be safely asserted a
priori that asepsis neither exists during nor after an operation
with the elastic ligature.

Circular Ligature.—The results of circular ligature in
the intestine were first noted in the clinical studies of several
French surgeons, Quénu, in particular, and their findings were
confirmed experimentally by Genersich, in Germany, and by my
clever friend, J. Henry Barbat, of San Francisco.

The results vary according to the condition of the bowel;
in cats previously purged or starved for twenty-four hours, a
tight ligature causes a necrotic process similar to that described
in lateral anastomosis by the ligature method.   The serosa
completely covers the ligature within 36 hours, and on or about
the fifth day the ligature passes into the intestine, the lumen of
which becomes pervious as early as the 9th day.   When the
ligature was left loose, it remained *in situ,* and always failed
to pass into the gut, death occurring from inanition sometimes
as late as the nineteenth day.   No signs of ileus or peritonitis
were noticed in either of the two foregoing groups of experi-
ments.   In unprepared animals early death from toxemia fre-
quently resulted.   No peritonitis was present at necropsy.

The preceding statements were verified by three varieties
of experiments:

1st, A ligature (silk or rubber) was placed on the af-
ferent loop in von Hacker's gastro-enterostomy with entero-
enterostomy.

2d,   Lateral anastomosis between the ileum and pelvic
colon with ligature on distal end of ileum (Barbat).

3d, Circular ligature on the small intestine (Genersich),

or colon.   Specimens from all three varieties of cases show the lumen of the gut almost normal in diameter with a lineal scar plainly apparent beneath the serous coat.

In the domain of vascular anastomosis the ligature method proved very serviceable (Eck's fistula and Carrel's anastomosis between the carotid artery and jugular vein).

While our clinical experience* does not permit us to speak authoritatively on the indications of the use of the ligature method, a few facts may nevertheless be deduced from animal experimentation and an extensive study of the published clinical cases.

The *ligature anastomosis* is the quickest to make and the slowest to functionate.   Hence, we should never resort to this method when an immediate effect is required.   *Its field of usefulness is unquestionably in the various lateral intestinal anastomoses.   Here the ligature method may become the method of choice.*   Its adoption may be of service in the following conditions: Strangulated hernia, artificial anus, inoperable obstructive tumors of the intestine, as a preliminary step in the resection (Kocher) of large intestinal neoplasms.

In certain gastric conditions (incomplete pyloric stenosis, inveterate dyspepsia, ulceration) the elastic ligature may prove of service, but we should not overlook the fact that in these conditions the suture method in the hands of experienced men has proved eminently safe and satisfactory.

In incomplete malignant pyloric stenosis, the elastic method may prove useful at an early stage, but in late cases feeding cannot be retarded, and acute dilatation may prove dangerous.   Not the least of the objections to the ligature method are the tendency to do a palliative operation rather than a radical or curative one and the frequent abuse of an apparently simple operative method.

The perusal of the published reports of the elastic ligature demonstrates the absurd use made of the method, especially in this country, for complete pyloric obstruction of benign or malignant origin.   It were indeed truly difficult to preconize

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* Our elastic ligature operations in man comprise three posterior gastro-enterostomies and four lateral intestinal anastomoses, all very successful.

a more perfect mode of fasting in a condition of advanced starvation.

In complete pyloric stenosis, whether of bengin or malignant origin, the ligature method is to be severely condemned.* All dogs and cats subjected to a ligature gastro-enterostomy and occlusion or exclusion of the pylorus, died of convulsive autointoxication. Chas. Mayo and Maury report similar experimental findings.

While anastomosis by the ligature method belongs logically to the class of operations in two stages, all of which have for obvious reasons been gradually abandoned, notwithstanding their apparent advantages, sufficient evidence, both experimental and clinical, has been adduced to render unquestionable the superiority of the elastic ligature in various lateral intestinal anastomoses.

On the other hand, the ever-increasing *furor operandi* and particularly the surgeon's surreptitious invasion of the medical man's domain—gastric ptosis and atonic dilatation—call for simple and truly safe surgical measures. The elastic ligature apparently fulfils both of these conditions, but prolonged clinical experience alone can determine its practical value, its indications, its limitations; and, while its simplicity of technique may render it popular with surgeons unduly fearful of peritoneal contamination and unskilled in the use of the needle, experienced men cannot, barring rare circumstances, be expected to give preference to " devices that work while the surgeons are asleep."

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* In the skillful hands of Ochsner the elastic ligature gave five deaths in a series of 28 patients with malignant obstruction of the pylorus.

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THE REVERSAL OF THE CIRCULATION IN A LIMB.

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I. INTRODUCTION.

THE circulation may be said to be reversed in a limb when the red blood flows through the veins in a direction opposite to the venous normal circulation, and the dark blood returns towards the heart through the arteries.

The reversion may be brought about by cutting the main artery and vein of a limb and uniting the central end of the artery to the peripheral end of the vein and the peripheral end of the artery to the central end of the vein. Then from a functional point of view, the vein becomes an artery, and the artery a vein. The capillary circulation is also reversed.

II. OBJECT.

These experiments have been undertaken with the view, both physiological and surgical, of studying the changes of the circulation of the limb after reversal; and of finding a method of preventing gangrene, when the arteries of a limb become unable to carry the red blood to the capillaries.

III. HISTORY.

The reversal of the circulation in the saphenous vein of a dog was attempted by Dr. Berard, associate professor of surgery in the University of Lyons, and Carrel, in 1902, in the laboratory of A. Lumière. The femoral artery and the saphenous vein having been cut in Scarpa's triangle, the central end of the artery was connected by circular suturing[1] to the peripheral end of the vein. After restoration of the circulation, the saphenous vein appeared greatly distended and pulsating,

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pulsations being easily perceived even in its course in the leg below the knee. The animal died from infection two days after the operation.

Afterwards, in the laboratory of Professor Soulier, Carrel and Morel succeeded in reversing the circulations in the jugular vein.[2] The carotid artery, and the external jugular vein, having been cut, the central end of the carotid was united to the peripheral end of the jugular, by circular suturing. The jugular became red, distended, and pulsated like an artery. By auscultation, a strong systolic murmur was heard at the anastomosis. The animal was under observation for several months after the operation, and during this time the vein maintained its arterial functions.[3]

Prior to this, in the same year, a Spanish surgeon, San Martin y Satrustegui,[4] attempted to establish a lateral anastomosis between the femoral artery and vein in three goats. Obliteration of the vessels occurred. Afterwards he performed this operation on two patients affected with gangrene of the lower limb. In one case the operation was entirely unsuccessful. In the other, the gangrene stopped, but this was probably due to the fact that the affected portion was amputated at the time the anastomosis was performed.

After these first experiments, a French surgeon, Professor Jaboulay, established a lateral anastomosis of the femoral vein and artery, in a patient suffering from gangrene produced by endarteritis.[5] The operation was not successful, and an amputation became necessary.

In 1903, Gallois and Pinatelle, assistants of Jaboulay, published the results of this operation, and of the experiments which they had made in order to investigate the possibility of the reversal of the circulation.[6] Their experiments were performed on a cadaver. A colored fluid was injected under pressure into the main vein of a limb. The fluid returned immediately by all the other veins of the limb. After occlusion of these veins by forceps, it was impossible to cause the fluid to flow through the main vein. They conclude that the cir-

culation of a fluid through the main vein of a limb, in a direction opposite to the normal circulation, cannot be established, owing to the presence of the valves, and that joining the central end of the artery to the peripheral end of the vein is not justifiable.

In this paper the possibility of the reversal of the circulation, and the nature of the operation necessary to bring it about, will be discussed.

IV. POSSIBILITY OF THE REVERSAL OF THE CIRCULATION.

In order to flow through the veins in a direction reverse to the normal, the red blood must overcome the following three physical obstacles

(*a*) The valves;

(*b*) The numerous anastomosing veins, which decrease the blood pressure by increasing the area of the cross-section of the vessels;

(*c*) The resistance of the capillaries.

Logically, owing to these obstacles the reversal seems impossible.   Besides, the experiments of Gallois and Pinatelle indicate that the red blood cannot get beyond competent valves. But their experiments were made on a cadaver. Before adopting their conclusions, therefore, it is necessary to consider that the living tissues have a very strong power of adaptation, and to therefore experiment on the living animal. With this view the two following experiments were performed.

EXPERIMENT I.—Interposition of a segment of the femoral vein between the two cut ends of the femoral artery with reversal of the circulation in two collaterals of the vein (7).

May 12, 1905. Medium-sized, strong young bitch.

A. Technique (summary).—Etherized dog. Four centimetres below Poupart's ligament the femoral artery was sectioned. A displaced segment of the femoral vein was interposed between the two ends of the artery, which restored its continuity. This venous segment had two branches, one of which received the dark blood from the adductors, the other from the quadriceps. (Fig. 1, p. 206.)

After restoration of the circulation, Scarpa's triangle was dissected.

The edges of the wound having been joined by means of several forceps, the skin was covered with hot moist compresses. From time to time the wound was reopened, in order to observe the state of the circulation.

B. Results. On release of the clamps on the vessels, the red circulation was immediately established through the venous segment. But the two small collaterals—the vein of the adductors, and the vein of the quadriceps—remained filled with dark blood.
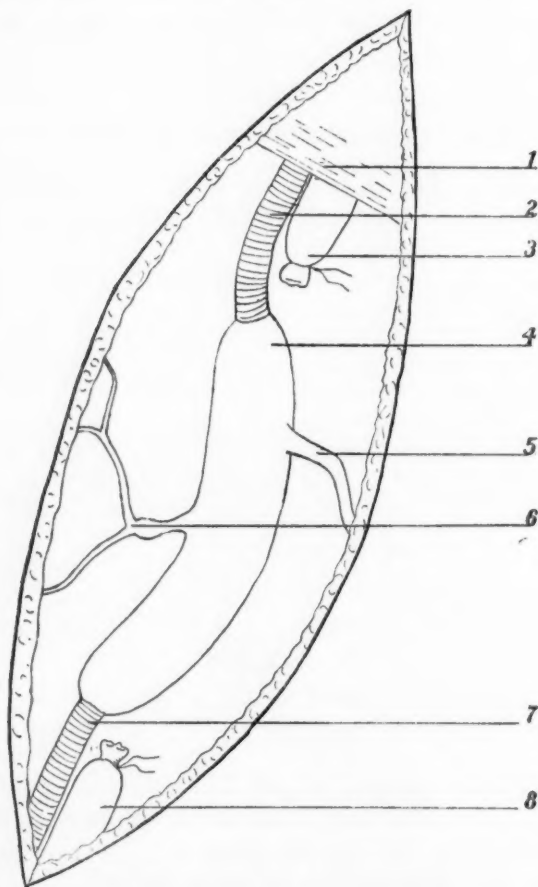

FIG. 1.—Interposition of a segment of the femoral vein, between the cut ends of the emoral artery: 1, Poupart's ligament; 2, femoral artery; 3, femoral vein; 4, a vein from the adductors; 5, a vein from the quadriceps; 6, peripheral end of the femoral artery; 7, peripheral end of the femoral vein.

Fifteen minutes after the operation the red blood had entered the vein of the adductors and pushed the dark blood towards the periphery. A portion of this vein about 3 cm. long and located near the femoral

vein assumed an arterial hue and pulsated strongly. The peripheral ramifications near the muscles were yet filled with dark blood. On making a pressure with the hand upon the adductors, in order to increase the blood pressure in the peripheral ramifications of the vein, the dark blood forced all the red blood out of the collateral vein into the venous segment. On release of the pressure upon the muscles, the dark blood was again displaced by the red blood and filled the vein to its peripheral ramifications, the latter remaining dark. The line separating the red from

FIG. 2.—Reversal of the circulation through a small valvular vein, one hour after the operation, the valve being not yet forced: 1, central end of the femoral artery; 2, a segment of the femoral vein; 3, small venous branches filled with dark blood; 4, valve; 5, vein filled with red blood; 6, peripheral end of the femoral artery.

the dark blood was stationary. Therefore, no arterial circulation through the vein of the adductors occurred up to this time.

The vein of the quadriceps was filled with dark blood. Near its mouth, a small dilatation was observed, above which the blood was red and below which it was dark. (Fig. II.) This dilatation was pulsating like a small aneurysm. Its lower end marked the location of a valve.

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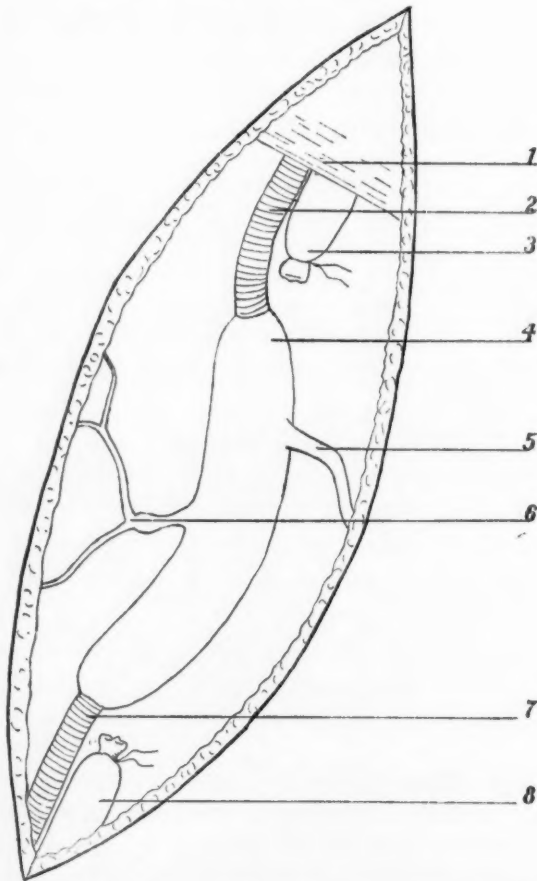

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When pressure was made upon the muscle the dark blood, passing through the valve, flowed into the red current of the femoral vein. On release of the pressure the red blood penetrated again the dilatated portion but did not pass beyond the valve.

One hour after the operation the adductor vein and its peripheral ramification had become red. The fine branches appeared like small arteries, after having been dissected out from the muscles as far as pos-
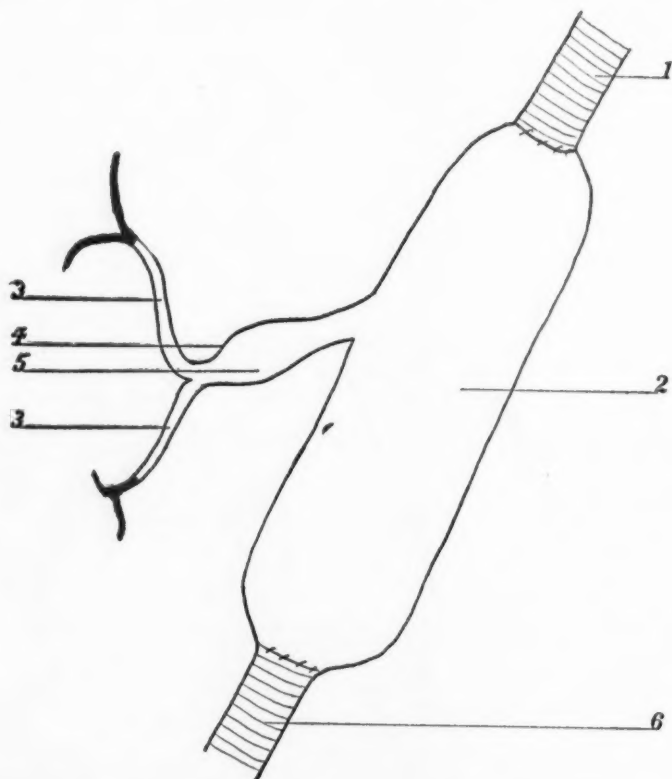

FIG. 3.—Reversal of the circulation through a small valvular vein; two hours after the operation, the valve being forced: 1, central end of the femoral artery; 2, a segment of the femoral vein; 3, small venous branch filled with red blood, the dark blood being compelled to flow towards the periphery; 4, forced valve; 5, vein filled with red blood; 6, peripheral end of the femoral artery.

sible. There was no circulation of red blood through the vein of the quadriceps.

Two hours after the operation the red blood was seen to pass through the valve of the vein to the quadriceps and to push the dark blood outward, (Fig. III.) but it appeared to stop before reaching the peripheral portion

of the vein and the fine intra-muscular branches, which remained filled with dark blood.

Two hours and a half after the operation all the peripheral and intra-muscular ramifications had become red. It was not observed if the small artery of the adductors was filled with dark blood at this time.
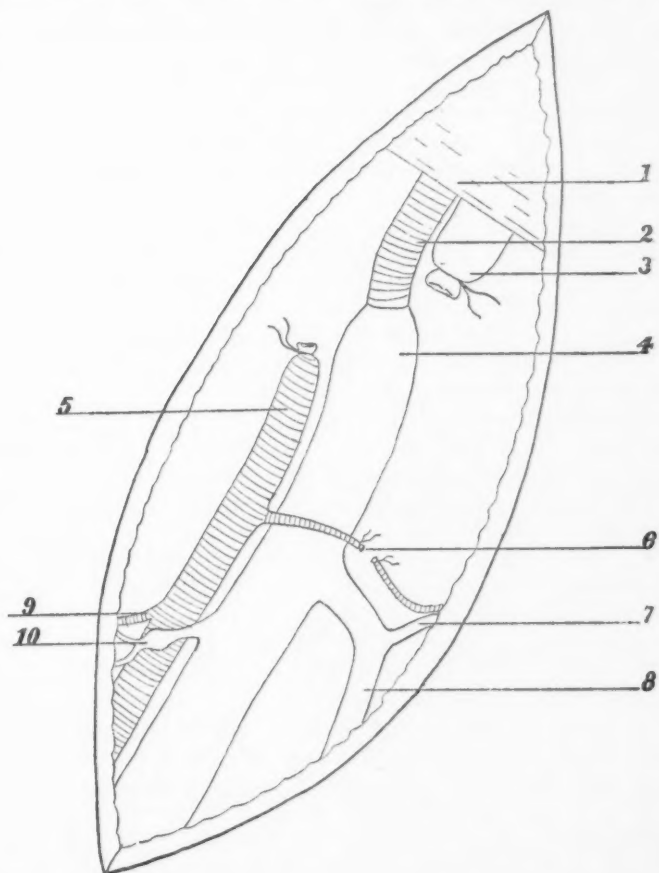

Fig. 4.—End to end anastomosis of the central end of the femoral artery to the peripheral end of the femoral vein: 1, Poupart's ligament; 2, central end of the femoral artery; 3, central end of the femoral vein; 4, peripheral end of the femoral artery; 5, peripheral end of the femoral vein; 6, an artery to the adductors; 7, a vein from the adductors; 8, saphenous vein; 9, an artery to the quadriceps; 10, a vein from the quadriceps.

EXPERIMENT II.—Reversal of the circulation in a limb. June 22, 1905. Medium-sized, very strong young bitch.

A. Technique (summary). Etherized dog. Two centimetres below Poupart's ligament the femoral artery and vein were cut, and the central

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end of the artery united to the peripheral end of the vein, by circular suturing.   (Fig. IV, p. 209.)

After restoration of the circulation, the saphenous vein and its collaterals, the femoral vein, the deep veins of the leg and their collaterals, the superficial veins of the foot, the femoral artery and the small arteries of the adductors and of the triceps, were dissected out. Afterwards the edges of the incision were joined by means of forceps, and hot moist sponges were placed over the part. From time to time the wound was reopened, and the condition of the circulation observed.

B. Results. Immediately after the operation, the arterial blood, passing through the anastomosis, flowed into the femoral vein, which assumed an arterial hue and became very distended. To the touch, strong pulsations were manifest.

The arterial blood did not enter the mouth of the saphenous vein, which was situated in Scarpa's triangle near the apex. The blood in the saphenous vein remained dark. Its walls were distended, owing to stasis of the venous circulation and to the increase of pressure in the femoral vein. No pulsations were perceptible to the touch. Three centimetres below its mouth, a branch was given off to the adductor muscles. This collateral was dark and did not pulsate.

Fifteen minutes after the operation the walls of the femoral vein were less distended. In the popliteal region the vein divided into two branches, one of which was red, the other dark. The saphenous and the superficial veins of the thigh, of the leg, and of the foot were distended with dark blood and did not pulsate.

While inspecting the circulation in the veins, the first valve of the saphenous vein was seen to give way. The red blood slowly entered the mouth of the saphenous vein, pushed the dark blood toward the periphery as far as the mouth of the adductor vein, and then stopped. Immediately below this point a little dilatation filled with red blood was observed. The lower end of this dilatation marked the location of a valve—the second valve of the saphenous vein—below which the vessel was filled with dark blood. Almost immediately the arterial circulation was established through the adductor vein, which became red and began to pulsate.

About thirty minutes after the operation the lower portion of the saphenous vein suddenly became filled with red blood, which flowed towards the upper portion of the vessel; *i.e.,* centrally. Thus, the whole vein became filled with red blood, but the direction of the current was not the same in the superior and the inferior portions of the vessel. By pressing the blood from the superior segment of the vein, and then removing the pressure in order to allow the circulation to become re-established, it was seen that the red blood was flowing from the femoral vein to the vein of the adductors, but that it was unable to get beyond the second valve of the saphenous.

The same experiment showed that, in the portion of the vessel located below the second valve, the blood flowed from the periphery to the

centre, *i.e.*, in the direction of the normal venous current.   The red blood entered the lower part of the vein through the anastomoses between the deep veins of the leg, but all the valves of the saphenous vein were not yet forced.   All the superficial veins were yet dark.   On each of them and very close to the saphenous, a small dilatation filled with red blood was observed.

An hour after the operation a small branch from the femoral artery accompanying the vein to the adductor muscles was doubly ligated near its origin and cut between the ligatures.   A small opening was then made through the wall, just peripheral to the distal ligature.   At first no blood escaped, but about fifteen minutes later, dark blood began to escape, and the rate of flow gradually increased.

The peripheral end of the femoral artery immediately below the ligature was then hemisected.   A large hemorrhage of red blood occurred, in which it was possible to see several lines of dark blood, the whole being comparable to the mingling of the water of a small, muddy stream with the clean water of a large one.

Two hours after the operation, dark blood flowed from the branch of the femoral artery to the adductors, on opening the wound in its wall. A transverse section of the peripheral end of the femoral artery gave rise to a large hemorrhage, consisting of red and dark blood in about equal proportions.

Three hours after the operation the saphenous and femoral veins and most of their branches were filled with red blood and pulsated like arteries. Almost all the valves of the saphenous were forced, but when it was emptied by pressure it was observed that the red blood flowed more easily upward than downward, and that the second valve had not been forced.

The artery of the adductors was dark, and had the appearance of a vein.   An incision of its wall gave an abundant hemorrhage of dark blood only.

The femoral artery was distended, without pulsations, and of a venous hue.   Hemorrhage produced by a lateral wound consisted mainly of dark blood, but in it could be seen a few lines of red blood.   All its collaterals were filled with dark blood excepting a deep one coming from the posterior part of the thigh, which remained filled with red blood.

Four hours after the operation, the femoral vein and its collaterals, the saphenous vein, and the veins of the leg and foot, were filled with red blood, but a large collateral in the popliteal region and a few small collaterals along the course of the saphenous vein remained filled with dark blood.   If pressure was made on the muscles, the dark blood in the collaterals of the saphenous vein entered the main trunk, where it could be seen through the vessel-wall as a black line in the red blood.   This shows that the blood-current through the lower part of the saphenous was directed upward (central), as far as the mouth of the adductor vein, and that, from this point to the femoral vein, the current was downward (peripheral).   The second valve of the saphenous had not yet been forced.

Abundant hemorrhage of dark blood from the artery of the adductors was observed on opening the vessel-wall. The femoral artery was distended by dark blood, which was mingled with a very small quantity of red blood which came from an anastomosis with the arteries of the posterior region of the thigh.

The dog was killed five hours after the operation.

These two experiments demonstrate that:

(a) The valves prevent, at first, the reversion of the circulation in the veins.

(b) After a short time, the valves gradually give way and the red blood flows through the veins as far as the capillaries.

(c) Finally it passes through the capillaries, and the arteries are filled with dark blood. Probably dark blood also returns from the capillaries towards the heart through some veins.

(d) Practically complete reversal of the circulation is established about three hours after the operation.

V. THE OPERATION PROPER TO ESTABLISH THE REVERSAL.

The above experiments show that the main artery and vein of a limb having been cut, the anastomosis of the central end of the artery to the peripheral end of the vein produces the reversal of the circulation. The operation is completed by uniting the central end of the vein to the peripheral end of the artery, in order to permit the dark blood, which fills the artery when the circulation is reversed, to reach the heart. Perhaps it is not absolutely necessary to perform this second anastomosis, for the dark blood may come back from the capillaries to the heart through other veins. Further observations on this point will be made.

Another operation, consisting of a lateral anastomosis between an artery and vein, without occlusion of the trunk of either vessel, will be discussed, for the reason that it has been used,—unsuccessfully, however,—with a view almost similar to ours.

In order to determine the result of this operation, the following experiment was performed:

Lateral anastomosis of the femoral artery and vein. July 7, 1905. Small-sized, strong young dog.

A. Technique (summary). Etherized dog. A lateral anastomosis was established between the femoral vein and artery in Scarpa's triangle on the right side. Temporary hæmostasis being accomplished by means of suitable artery forceps, a longitudinal incision about 12 mm. long was made through the wall of the artery and vein. The posterior edges and afterwards the anterior edges of the wound, were approximated by a continuous suture. The opening between the artery and the vein was about 1 cm. long.

A short time after the operation the arteries and the veins of the limb were carefully dissected and observed.

B. Results. After removing the clamps on the vessels, the red blood flowed through the anastomosis from the artery to the vein, and the latter became distended. This anastomosis did not produce stenosis of the arterial channel, the circulation through the artery below the anastomosis apparently being normal.

Ten minutes after the operation, above the anastomosis, the vein was red and to the touch, systolic pulsations were manifest. Almost immediately below the anastomosis, the vein became darker, and one and one-half cm. lower it presented the normal hue of a vein. It was markedly distended, but no pulsations were observed. The saphenous vein, in its inferior portion, was distended, but without pulsations.

Sixty minutes after the operation there was a normal red circulation through the artery. An active red circulation through the central end of the vein was observed. No circulation through the peripheral end of the vein could be seen. Below the anastomosis, the first three centimetres of the vein had become red. The walls were distended and pulsating as far as the inferior part of the thigh, but obviously there was no circulation, for the hue remained venous.

The adductor vein, the mouth of which was about two centimetres below the anastomosis, was dark and distended.

No red circulation through the superficial veins of the foot, or through the saphenous vein. Phonendoscopic ausculation showed:

(*a*) On the central end of the artery, a strong continuous murmur, with rude systolic increase;

(*b*) On the central end of the vein, a very strong systolic murmur;

(*c*) On the peripheral end of the artery and of the vein, a continuous murmur.

On clamping the peripheral end of the vein, no modification of the continuous murmur by auscultation on the anastomosis could be detected. When the clamp was placed on the central end, the continuous murmur ceased immediately, and was succeeded by a systolic murmur.

Two hours and forty minutes after the operation, above the anasto-
mosis, and also, as far as 4 cm. below the anastomosis, the vein was red
and pulsated strongly, but in the inferior part of the thigh it was dark.
The adductor vein was dark, distended and pulsating. Near the mouth a
small red column, about 1 cm. long, was observed. The saphenous vein
was dark and congested. No red circulation could be detected through
the vein of the foot.

A lateral opening made through the wall of the inferior portion of
the femoral vein produced a large hemorrhage of dark blood. A com-
plete section of a vein of the foot produced a large hemorrhage entirely
of dark blood.

Three hours after the operation no evidence of a reversal of the circu-
lation could be detected. At this point the experiment was discontinued,
and the animal killed. The post-mortem examination showed a large
communication, about 1 cm. long, between the artery and the vein.

This experiment demonstrates that :

(*a*) After lateral arterio-venous anastomosis a very large
portion of the red blood returns immediately toward the heart
through the central end of the vein.

(*b*) The peripheral portion of the vein and its collaterals
are distended and pulsate, but the valves are not forced and the
red blood does not circulate through them.

(*c*) Three hours after the operation, all the valves are
yet competent, and no beginning of the reversal of the cir-
culation can be detected.

VI. CONCLUSIONS.

1.   The reversal of the circulation in a limb of a dog is
possible.

2.   It can be established by an end to end arterio-venous
anastomosis.

3.   Under the same conditions, the lateral anastomosis
does not establish the reversal of the circulation.

The permanent results of these operations, a series of
which are being performed under aseptic technique in this
laboratory, will be published later. If normal nutrition of the
limb were possible, and the results of the end to end anas-
tomosis permanent, the operation would perhaps be proposed

for the preventive treatment of gangrene following obliteration of the arteries.

We wish to thank Dr. Stewart for granting us the privileges of this laboratory.

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CARCINOMATOUS METASTASES DEVELOPING OVER THREE YEARS AFTER REMOVAL OF THE BREAST WITHOUT LOCAL RECURRENCE.[1]

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Of fundamental importance in the decision of the question of the curability of cancer by operation is the localized character of the growth. When metastasis has occurred, no matter how thorough the removal of the primary tumor, the continued growth of the secondary deposits will nullify our efforts to obtain a cure. The modern methods enable us to cope with extensive local disease, and to follow it to the nearest lymph nodes with a reasonable hope of thorough eradication, and of freedom from recurrence. But a single distant metastatic deposit renders us practically helpless.

If the presence of a secondary deposit in a situation whence it can be removed by excision of the tumor, or ablation of the affected part or organ, is recognized at the time of proposed removal of the primary tumor, three questions arise: 1st, Shall we remove the primary tumor alone? 2d, Shall we remove both primary and secondary tumors? 3d, Shall we decline any operation?

(1.) In certain cases the primary tumor causes symptoms which seriously inconvenience the patient or threaten life, and then the tumor should be removed if the operation is not too severe, even when the secondary tumor cannot be removed. As there is no hope of a radical cure, extensive operations are not advisable, and, fortunately, comparatively slight operations afford the desired relief in such cases.

(2.) Under certain circumstances, as when the patient is in vigorous condition, when both primary and secondary tumors are easily removable, and when there is absolutely no

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[1] Read before the New York Surgical Society, October, 1905.

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sign of other deposits of the disease, we might venture on the thorough removal of both tumors. The justification for this course lies in the abundant evidence in careful postmortem examinations that a single secondary tumor may reach a very full development, even sufficient to cause death, without any other metastatic deposits, and that this may occur even while the primary focus is still limited in extent and easy to remove. Such single secondary deposits may develop in the kidney, the other breast, or in a distant bone of the extremities, from a primary carcinoma of the breast, and all of these lesions might offer an opportunity for successful surgical treatment.

(3) But in my personal experience I cannot recall a case in which the conditions were such as to justify removal of a distant secondary tumor at the time of operation on the primary tumor. Even when the secondary tumor appeared or was discovered after successful removal of the primary focus without local recurrence the conditions have never warranted operation. In every case the patients' general condition has been poor or it seemed probable that other secondary deposits existed although they were not evident. We must conclude, then, that in practice one will rarely meet with a case of malignant disease in which it will be good surgery to remove both the primary lesion and a distant metastasis.

The occurrence of secondary deposits which gave no symptoms and could not be recognized at the time of operation for the original disease, but soon became evident afterwards is unfortunately very common. We need only emphasize the necessity for a careful examination of the entire body before undertaking the removal of a malignant growth, in order to discover, if possible, any such secondary tumors.

Our results in the removal of malignant growths have so greatly improved that we feel fairly confident of freedom from local recurrence if the operation can be performed before the disease has spread too far. This freedom from local recurrence is often spoken of as a cure of the disease and in fact a permanent cure is often effected. But in the individual case we are still uncertain as to the length of time which should elapse without local recurrence before the patient can be considered free from danger of any return. When operations

were less complete and thorough than they now are, the number of patients who remained well for three years or more was not very great. It is not surprising, then, that late recurrences locally, or late appearance of secondary tumors, were rarely observed. Now, however, a very large number of persons have survived for long periods after the removal of the primary tumor, and there must be an increasing number of cases with late recurrence. This is indicated by the fact that there is a constant demand for a lengthening of the period which must elapse before a cure can be claimed, even limiting the question to the local or regional recurrences. The old period of three years of freedom from recurrence has been generally discarded and we hear demands for five years, ten years, or even longer periods. If we take into consideration not merely the local recurrences, but include the late-appearing metastases, ten years is not too long, as shown by the following cases operated upon by me. I have reported only those cases in which the secondary deposits were observed three years or more after the removal of the primary tumor, without local recurrence.

CASE I.—Annie C., thirty-seven years of age, married, born in Ireland. Carcinoma of left breast, with slight axillary involvement; removed October 11, 1889, at St. Luke's Hospital. A recurrent nodule formed in the scar and the latter with the entire pectoralis major muscle was removed January 13, 1890. The other breast became carcinomatous and was removed with the pectoralis major December 16, 1892. Dr. H. H. Robinson, of Goshen, examined her and kindly reported November 18, 1895, that there was no sign of recurrence. Soon after vague symptoms of intrathoracic complications arose and she died August 25, 1896, of a secondary tumor in the mediastinum, pushing forward and involving the ribs and sternum on the left side, nearly four years after the last operation. (Letter from Dr. T. D. Mills, of Middletown.)

CASE II.—Florence A. C., thirty-eight years of age, widow, born in United States. Carcinoma of right breast, numerous small glands in axilla. Removed breast and axillary contents March 22, 1894, at the General Memorial Hospital. The wound became slightly infected but healed in about four weeks. She

remained well until February, 1904, ten years after the operation, when examination showed some swelling of the sternum and the supraclavicular glands of the opposite (left) side became enlarged. There was no local recurrence. There was dulness on percussion over the sternum and to the left of it, with diminished breathing over most of the left lung. She had a dry cough, resembling the reflex cough of thoracic aneurism. Three weeks later, in a violent fit of coughing she suddenly lost part of the field of vision in the right eye and Dr. E. J. O'Shaugnessy, of New Canaan, wrote that an examination of the eyes revealed a tumor in the fundus. She died in April or May, 1904.

Case III.—Minerva K., forty-three years of age, married, born in New York. Carcinoma of the left breast; removal with the axillary contents at the General Memorial Hospital, April 11, 1895. She remained well until March 14, 1901, when she complained of dyspnœa and cough and pain in the scar, which remained healthy. Nothing could be found of an abnormal character in the examination of the chest. The symptoms gradually grew worse, and when examined November 30, 1903, marked physical signs of internal thoracic deposit were discovered. There was also great enlargement of the sternum. There was no local recurrence. She has not been seen since, and has probably died.

Case IV.—Mary A. B., sixty-five years of age, married, born in New York. Carcinoma of the left breast, several nodules following a chronic mastitis. Breast and axillary contents removed at the General Memorial Hospital March 21, 1896. I saw her October 18, 1899. She had hematuria and the left kidney was enlarged. The scar was healthy. March 8, 1901, Dr. G. A. Crump wrote that she still had hematuria, and that there was a growth in the vagina which felt like colloid material and bled readily. The breast scar remained free from recurrence. She died soon afterwards.

Case V.—Harriet E. K., forty-nine years of age, married born in New Jersey. Carcinoma of the right breast, glands small but extensively involved. Breast and axillary contents removed at the General Memorial Hospital, April 27, 1896. In August, 1899, I examined her and found no local recurrence. She had some vague nerve symptoms which I ascribed to hysteria and morphine addiction, as both conditions were present. Soon

after, paralysis slowly developed, with curvature of the spine and severe neuralgic pains. She died in March, 1901, and Dr. J. Arthur Booth, who had charge of her towards the end and made the autopsy, kindly informed me that he found carcinoma of the vertebræ and some nodules also in the spleen.

I could add to these some cases of tumors in other situations, such as a pylorectomy for carcinoma remaining well until a tumor of the iliac bone developed five years later; and a sarcoma of the foot treated by local excision, without local return, but the patient died of pulmonary sarcoma in three years. But in order to make the material homogeneous I have limited the cases to those associated with tumor of the breast.

I have made no search in the literature for similar cases, as I believe that the cases there are as yet too isolated to be of much value, but the following were at hand and may be mentioned:

Poulsen (*Arch. f. kl. Chir.* xlii. S. 616,) reported three cases of amputation of the breast with late metastases, the patients dying from five to eight years after the operation. Schmidt (*Deuts. Zeitschr. f. Chir.* xxvi. S. 139), recorded a case of death from metastasis in lungs and liver seven years after removal of the breast. Clairmont (*Arch. f. kl. Chir,* 1904, lxxiii. S. 620) reported a case of late metastasis in the bronchial glands ten years after a nephrectomy for adrenal tumor. König (*Verh. Deutsche chirurg. Congress,* 1903, S. 72) mentioned two cases of late secondary in the neck, ten and thirteen years after removal of the breast. Lomer (*Zeitschr. f. Geb. & Gyn.* Bd. 50, S. 358) quoted from Lubarsch (personal communication) an autopsy on a woman who died of pneumonia, whose left breast had been amputated five years before, microscopic examination of the axillary glands on the left side showing carcinomatous nodules present in them, but the cells showed no mitoses. Petersen (*Beitr. z. kl. Chir.* 1904, xliii. S. 171) quoted a case of von Beck in which a patient died of intestinal obstruction three years after a pylorectomy, and a small carcinoma was found in the sigmoid flexure and also a nodule of carcinoma in the center of a small uterine fibroid.

There had been no recurrence in the stomach. Labhardt (*Beitr. z. kl. Chir,* xxxiii. S. 571) collected several cases, of which two can be added to our list, death from metastasis in the liver five years after removal of breast (von Meyer) ; and in the lung ten years after a similar operation (Jones and Platt).*

Two hypotheses suggest themselves by which to explain these peculiar cases. We may suppose that these late-developing tumors are independent growths, an hypothesis which will account for some cases very readily, especially when the secondary tumor lies in an organ commonly attacked by primary carcinoma, such cases as involvement of the other breast after one has been removed, or of cancer of the stomach or uterus following cancer of the breast. But the numerous cases with involvement of lungs and liver, organs in which primary carcinoma is rare, do not admit of this explanation. Secondly, we may suppose that the cells from which the secondary tumors spring may have been deposited before the removal of the primary tumor, but have lain latent or developed so slowly that they do not become clinically evident for many years. Opposed as this theory is to our preconceived ideas of the growth of carcinoma, and especially of the tumors secondary to carcinoma of the breast, there is considerable pathological evidence of its probability. When a late local recurrence also takes place we have clear proof that some cells left by the operation have lain latent, and these are not so uncommon, but in our cases there was no local return.

Such authorities as W. Petersen (*loc. cit.*), Lubarsch (*Zur Lehre v. d. Geschwülsten u. Infektionskrankheiten*), M. B. Schmidt (*Die Verbreitungswege der Karzinome u. s. w.,* Fischer, Jena, 1903), Lomer (*loc. cit.*), Fraenkel (*Wien. kl. Wch.* 1898, S. 465) and Schuchardt (*Centr. f. Gynek.* 1901. S. 664) argue that in most cases of carcinoma the actual metastases are much more frequent than supposed, and that probably few primary operations really eradicate all the disease, yet an apparent cure may be obtained lasting for many years. The carcinomatous deposits left behind remain latent

*See also Schroeder, *Beitr, z. kl. Chir.* xlv. S. 685-6, Fälle 6, 7, 9, 10, 12, 13.

and may even undergo retrogressive changes as in Schuchardt's case, in which peritoneal nodules with ascites were found when a carcinoma of the pylorus was removed, yet on autopsy after death from pleurisy over two years later, not only was there no recurrence in the stomach, but the peritoneal nodules had entirely disappeared. We know well how the tissues and cells resist various bacterial infections by phagocytosis, by encapsulation with fibrous tissue, or by direct action of antitoxines upon the bacteria. It is not impossible to imagine that the carcinoma cells could be attacked by the same means, and we can even form the hypothesis that a thorough removal of the primary tumor may not only get rid of the local disease, but may have a beneficial effect upon the resistance of the tissues to the secondary deposits. So much is now appearing with regard to cytolytic ferments and their actions that it seems quite within the bounds of probability to suppose that the large mass of cells in the primary tumor may keep in circulation some chemical bodies which unfavorably affect the resistance of the tissues, and that the removal of this factory of toxic substances might restore the normal resisting power, and enable the tissues to destroy or encapsulate small deposits of cancer cells.

It might be well to note the bearing of these facts and theories upon the usefulness of the operative treatment of cancer. While the cases related detract somewhat from the brightness of the prospects for a radical cure by operation, the number of persons who suffer from these late appearing metastases is not large in comparison with the number of persons who remain free from local recurrences after successful removal of tumors. Even in these cases the interval of freedom is in itself enough to prove the practical usefulness of the primary operation, especially if it approximate ten years. A free interval of ten years at the time of life when the majority of the operations for cancer are performed affords a practical cure, for many of the patients will die of other causes before the disease returns or develops. It cannot be argued that if we cannot remove the disease entirely there is no use in the operation, neither can it be said that operations should be less extensive, leaving the

remainder to be dealt with by the resistance of the tissues. Practical experience is against both of these assertions, for the results have improved with the enlargement of the scope of operation. We may even claim that the facts are encouraging, because formerly we had supposed that immediate and prompt recurrence was to be expected when we left behind even the smallest portions of disease, whereas in the light of this evidence we can hope that minute cancerous deposits can be checked in growth or annihilated. Further, if our theory is correct, the removal of the primary tumor assists in this result. Similar effects are seen in the operations for removal of foci of tuberculous disease, for here, too, the results improve with the extension of the operations, and it is well known that the individual is assisted in his combat against a more or less general infection by being relieved of the principal mass of infected tissues.

CARDIO-SPASM.[1]

WITH REPORT OF AN OPERATIVE CASE.

BY JOHN F. ERDMANN, M.D.,

OF NEW YORK CITY,

Clinical Professor of Surgery in the University and Bellevue Hospital Medical College.

TWENTY months have elapsed since the operation in this case, having felt that a sufficient amount of time should be given to demonstrate a cure before reporting it in detail as a cure.

The patient, a female, thirty-three years of age, called upon me on the 7th day of September, 1903, and gave the following history: There was no family history of any note whatever that might in the least have any bearing upon her condition. She has been married four years, never had any children, and has had no occasion to be of a nervous temperament, although she had taught school for a number of years previous to her marriage.

Three years ago, had noticed a peculiar swallowing rattle, as she expressed it, in the throat, which in four or six weeks was followed by difficulty in swallowing foods and cold drinks, giving her an impression of pressure back of the lower portion of her sternum. All things seemed to go down the wrong way. At times she could apparently swallow substances to amount to a small slice of bread. There was invariably, after a short period, vomiting of the material swallowed, varying in extent from the entire quantity to about two-thirds of that swallowed.

From September to Christmas of 1902, she gradually lost weight, weighing during the holidays one hundred and twenty-five pounds, as compared to one hundred and eighty pounds in September—a loss of fifty-five pounds in three months. She now, September 1903, weighs one hundred and forty-four pounds.

She further states that she is positive from her sensations that the materials swallowed all collect or lodge above her stomach, and in the region of her pain, and that her pain is of a boring

character, travels up to her throat, and is somewhat increased during her menstrual periods. That lying down does not cause the ingested stuffs to flow out, but that she is more prone to backache when occupying this position. A small amount of mucus also is vomited each time. That she has gained the nineteen pounds in weight,—the difference between the Christmas weight of one hundred and twenty-five pounds and that of to-day, September seventh,—by the use of the stomach tube which some one of her physicians had recommended. She states that during the entire winter of 1902, large sized dilators and a stomach tube had been employed. Early in the history of her trouble hot drinks would relieve her pain, but at the present time are entirely inefficaceous.

Examination.—The patient is a female of large build, and rather poorly nourished, although she says her general health is good. Her skin and muscles are flabby. Abdominal palpation reveals no visceral enlargement. Lungs and heart negative.

Upon examining the œsophagus, No. 40F. enters readily until within the vicinity of the cardia, No. 26F. and No. 20F. also are checked at the same distance, while No. 16F. passed, but was gripped slightly. Successive sizes were then passed up to No. 26F.; a rest for twenty-four hours was advised, and bland, semi-solid food ordered. She returned on the following day, September 8, and owing to some soreness, No. 28F. only was passed. On September 9, she reports having swallowed some bread and a bit of beefsteak, without the use of the stomach tube. Bougies up to No. 36F. readily passed.

September 11 reports that she has been taking solids, but that she has a distinct sense of fullness at the usual site, before a satisfying quantity of food has been taken. To-day for the first time, complains of a lump or ball gripping her in the throat, pointing at this time to the larynx; No. 36F. passed. Patient wished to return to her home, so I instructed her to pass a large bougie herself, and No. 40F. was supplied her.

She did not report in person again until January 5, 1904, although by letter she stated that she was able to swallow fairly well, but still had her daily pressure and " fullness " sensations, and that she still vomits.

At this time, January 5, 1904, she is somewhat heavier than

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in September, 1903, and says that she has been taking bread and finely chewed meats, but still has her sternum pressure. No. 40F. bougie does not pass; No. 36F. passed with slight difficulty.

During the period dating from September 9, 1903, to January 5, 1904, I was inclined to feel that a fair element of hysteria had more or less to do with the spasmodic condition, and had her placed upon bromides and valerianates, basing my reasons for such medication upon her statements of increase in trouble at the time of her menstrual periods, and also upon the ball and gripping (globus hystericus) sensation in her laryngeal region.

She (January 5, 1904) now comes to me telling me that the diagnosis of œsophageal diverticulum has again been made, and desires me to again make a careful examination. I was satisfied that her lesion was at the cardia, because no deflection or check occurred to the bougie in any portion of the upper four-fifths of the œsophagus. For further satisfaction to the patient, and to eliminate any stomach lesion that might, by reflex, influence the cardia, I recommended her to Dr. George Roe Lockwood, who advised her to remain under his observation for a few days.

She returned home, and on January 11, was admitted in the Private Hospital Association under Dr. Lockwood's care.

10 A.M.—Tube passed and fed; unable to hold half-pint.

1 P.M.—About fourteen ounces of fluid taken without the tube.

5 P.M.—Dr. Lockwood passed the tube, and withdrew one pint of sour smelling liquid.

From this date on, until January 27 with few exceptions, the patient was fed by the tube, and occasionally by the rectum. A bougie was passed of largest size almost daily, and the stomach tube passed and allowed to remain for a period of thirty minutes. During this period there would be frequent expulsions or siphonages of various types of colored fluids, and of pap to fluid consistency, varying in quantity from a few ounces to several pints. Passing the bougie was easily accomplished one day, and the next an absolute obstruction would be met with, while the stomach tube rarely encountered any obstruction.

January 27th the patient weighs one hundred and thirty pounds, being a loss of fourteen pounds in a month.

Dr. Lockwood was satisfied that all mechanical and medicinal
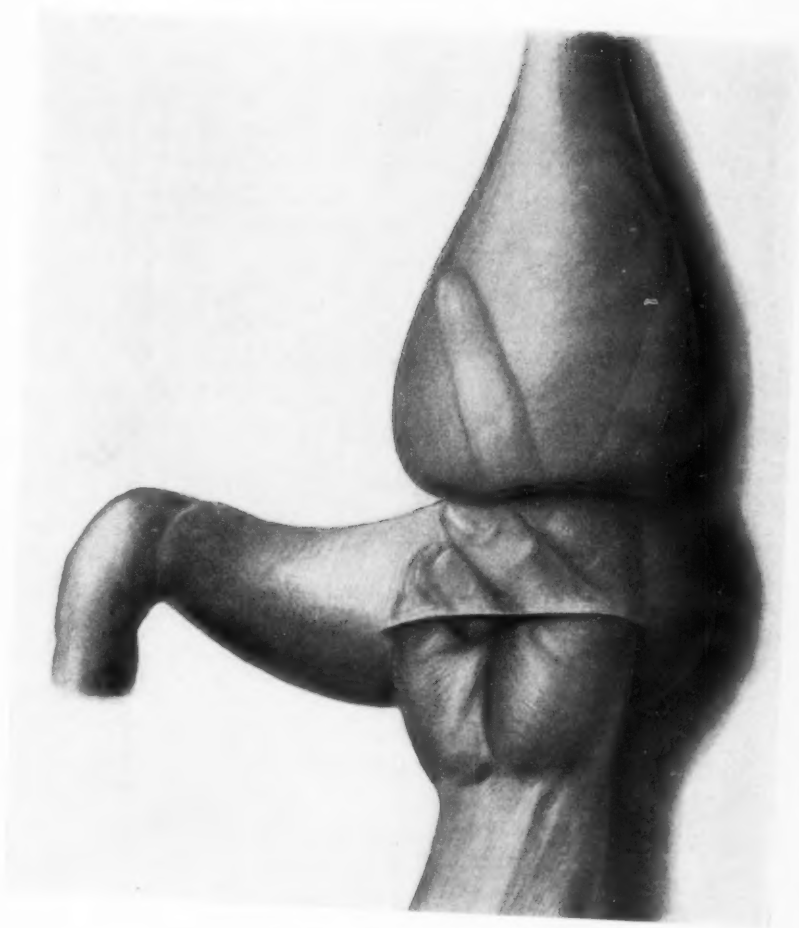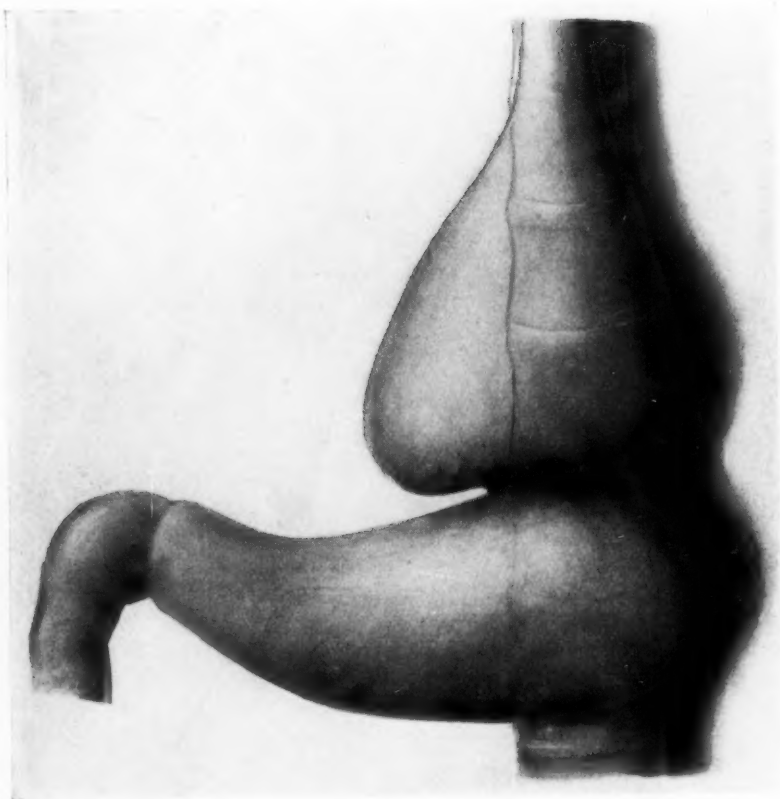
FIG. 1.—Cardio-spasm.

FIG. 2.—Cardio-spasm.

means had been given a fair trial, and suggested the Mikulicz operation, and to this I more than agreed.

The patient gladly grasped at some means of cure, and accepted the treatment, requesting the privilege of a visit to her home before submitting.

She returned, and came under my care in the same institution on March 6, 1904; was given calomel, and several hours later, the stomach was washed out with two pints of salt solution. The latter was repeated at noon of the day of the operation.

Operation, March 7, 1904.—Median epigastric incision about five inches long. Stomach easily exposed, was found lying in an absolutely transverse position, and contracted so that it was less in diameter than the large intestine. An incision was made in the long axis of the stomach, sufficient to admit the hand, in this instance about four inches long. (See Fig. 1.)

The cardia readily located, but impossible to introduce a finger. Dr. Lockwood, at my suggestion, passed an œsophageal bougie, and while holding my finger in the neighborhood of the cardia, I could feel, through the stomach's lesser curvature, the bougie passing down toward the right, then sweep over to the left, describing a distinct sickle curve; then the point entered the cardia, and passed into the stomach. The bougie was then gradually withdrawn, and followed by my index finger. After this it was an easy matter to introduce the second finger, and proceed with the dilatation (Fig. 1). The impression gained by visual observation of the stomach, and palpation of the walls of the œsophagus, is schematically represented by Fig. 2.

After the second finger, a third was introduced, stretching the non-resisting cardia fully four to six c.m. as suggested by Mikulicz. While the two fingers were in the œsophagus, up to the metacarpo-phalangeal junction, I struck by the absence of contact with the walls. Separating the fingers as widely as possible, I was just able to come in contact with the lateral surfaces. After completely outlining the walls by palpation, the impression of size and shape were given as shown in the illustration.

The pouch was located chiefly to the right of the spinal column, the vertebræ being readily outlined through the posterior wall. The opening in the stomach was closed by three rows of

sutures, the first and second being continuous chain stitch, and the third (Lembert).

Nothing of any note occurred after the operation, except bloody vomiting for twenty-four hours, and that on the ninth post-operative day a small sinus developed in the wound, which closed in three or four days. On the afternoon of the 8th of March a small quantity of water was allowed by mouth; nourishment entirely by rectum. Liquid nourishment was given by the mouth in small quantities on the third day; a raw egg on the fifth day; and on the seventh post-operative day she was given soft-boiled egg and bread, baked potato and gravy at different times.

From this time on nourishment of the more solid variety was given, and rectal alimentation was discontinued on the ninth day. The patient was discharged on the twenty-first day.

Numbers of grateful letters have been received from the patient, all containing the satisfactory news of increase in weight, and that no more of the former symptoms exist whatever.

At the close of the first year, she wrote that a gain of 35 pounds had been noted in her weight. About two months ago, she called upon Dr. Lockwood and myself, and stated that she was still a cured case, and had added a few more pounds to her weight of April second.

Mikulicz, in the " Deutsche Medicinische Wochenschrift," of January and February, 1904, has contributed quite an extensive article titled, " Zur Pathologie und Therapie der Cardio Spasmus," and reports four cases, two over one and a half years, and two about nine months post-operative duration, in which he calls attention to the differential diagnosis of these cases from carcinoma, diverticulum and stenosis, and dismisses the questions by citing but two of the symptoms and signs of this disease, both of which were well marked in this case. First the pear, or flask-shaped dilatation, invading the lower one third to two-thirds, which may be of such dimensions as to contain from a few ounces to two pints and over, and that owing to the spasm at the cardia the neck of the flask or small end of the pear-shaped dilatation is always upward (see illustration). The contents of this dilatation can be siphoned off, irrespective of those of the stomach, etc.

Second, the dysphagia of cardial type, well expressed in the history of my case, and attributable to the retained contents producing an erosion, or œsophagitis accompanied with erosions.

Under the question of ætiology, numbers of causes are given in his article, among them being. (I), primary cardio spasm (Mikulicz and Meltzer); (II), primary atony of the muscalature of the œsophagus (Rosenstein); (III), synchronosis paralysis of the circular œsophageal fibres; with spasm of the cardia due to a vagus involvement (Kraus); (IV), congenital, (Fleiner); (V), primary œsophagitis, (Martin).

The operation performed by me in this case was after the method of Mikulicz, as briefly but very indefinitely described in the above journal.

Treatment in these cases at this date resolves itself more into a mechanical than an operative treatment, with the latter as a final resort when instrumentation fails.

Mikulicz' idea in manual divulsion of the cardia was to produce a similar effect to that found in stretching any sphincter to a point productive of paralysis.   Whether he felt that by producing such paralysis and allowing of constant emptying, the muscle would return I do not know, but personally I feel that this effect should and could be obtained by this means.

That this paralysing effect is possible with properly constructed instruments, must be admitted, and recently H. Straus reports in the " Kleinsche Woch," No. 49, 1904, one case of a male 30 years of age, with a history of ten years' duration, cured or markedly improved by the use of a stomach tube, to the distal end (above the eye) of which an inflatable rubber bag is attached, in such manner as to appear that the tube had passed through the bag's or balloon's centre.   To the side of the stomach tube, a very small-calibred rubber tube is attached, that connects with the inflatable bag.   This tube terminates proximally in a mouth piece through which air is blown.   A safeguard in the shape of a mercurial pressure, regulating apparatus is used.

This instrument is introduced so that the bag when in the stomach is in a deflated condition, then air is blown in until the mercurial gauge showed pressure equal to complete

inflation. Air is then let out so as to partially deflate the bag, and then the tube withdrawn sufficiently to engage the distended bag in the cardia, and eventually pull it through. Numerous sittings are given.

Dr. Lockwood has devised an ingenious instrument, on the Kohlman uretheral dilator pattern, but has discarded it owing to its proving unsatisfactory. The same in a certain sense must be admitted of all instruments devised for this purpose, for the following reasons: Danger of rupture of the tissues by an instrument that cannot give the accurate impression of resistance that is given to the finger; inability to properly perceive the proper location by these devices, and thereby needlessly cause unnecessary discomfort; that in the rubber-bag variety, if the cardia is rather resisting, the air being driven downward, one of two things will occur: either the bag will rupture into the stomach, a matter of no consequence, or by forcible pulling, the air bag will flatten out and may produce serious visceral lacerations.

In conclusion I would suggest the following:

The use of some apparatus allied to Kraus', but with little force used in its extraction. Should several sittings not be followed by evidence of improvement and cure, that the operation of gastrostomy, with manual dilatation, as detailed above, should be done.

THE TREATMENT OF DIFFUSE SEPTIC PERITONITIS.[1]

BY ROBERT G. LE CONTE, M.D.,

OF PHILADELPHIA.

WHILE in Chicago a month ago I was astonished to hear Murphy say that in his last 29 cases of diffuse peritonitis he had had but one death; and the purpose of my remarks this evening is to recount his technique in these cases and bring the subject before you for discussion. The majority of us, I think, have been in the habit of douching the peritoneum with large quantities of sterile salt solution, with or without partial evisceration, where the infection was diffuse. This has been our practice at the Pennsylvania Hospital, and our mortality is probably between 70 and 80 per cent., for we receive many cases in the last stages of septic peritonitis, where operation is undertaken as the only chance in an otherwise hopeless condition. If more than 20 or 30 per cent. of such cases recovered, we fancied our technique was rather superior.

While the procedures of Murphy do not present anything particularly new, he has assembled in his technique all of the good things to do and has eliminated the unnecessary or harmful ones. His principles, from a theoretical standpoint, will appeal to everyone, and in practice the theory is sustained by the excellent results obtained. The essentials of his technique may perhaps best be stated under six headings:

1. The rapid elimination of the cause of the peritonitis, whether it be a perforation of the bowel, a gangrenous appendix, a ruptured pus tube, etc. This must be done with the least possible handling of the peritoneal contents.

2. Drainage by tube of the lowest portion of the pelvis through a suprapubic opening, and free drainage through the operative incision.

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[1] Read before the Philadelphia Academy of Surgery, November 6, 1905.

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3. The elimination of all time-consuming procedures at the time of operation.

4. The semi-sitting position of the patient after operation, the so-called Fowler posture.

5. The absorption of large quantities of water through the rectum, which reverses the current in the lymphatics of the peritoneum, making the surface of that membrane a secreting instead of an absorbing one, and also markedly increasing the secretion of urine.

6. The prevention of peristaltic movements of the intestines by withholding all food or liquids by mouth, and perhaps by the administration of opium.

You will notice that none of these essentials is absolutely new, for all of us have practiced one or more of them at different times on different patients. But while doing some of them we have omitted others and at the same time perhaps have done things that were unnecessary and harmful to the patient. Let me elaborate these points a little more fully.

First. In removing the cause of the peritonitis the less the peritoneal surfaces are handled the better, for nature has thrown out protecting lymph which inhibits the absorption of toxic substances and in handling such surfaces there is danger of bruising and rubbing off the lymph, opening up a new avenue for absorption and infection. Therefore Murphy believes that no attempt should be made to sponge the peritoneal surfaces or to wipe off any lymph that may be found, as such manipulation would increase the danger of septic absorption.

Second. When the patient is placed in the Fowler position the fluids in the peritoneal cavity will tend to gravitate towards the pelvis, and in addition the action of the diaphragm during respiration will help to pump the fluids in that direction, making drainage of the lowest part of the pelvis with a tube very important. If there is sufficient fluid in the pelvis to fill the tube, each excursion of the diaphragm will pump a certain amount of it out, which will be absorbed in the dressing. It must be remembered that it is not the quantity of fluid present which is harmful, but rather the extent of the peritoneal

surface which comes in contact with it, so that a quart of pus contained in a round cavity would be less dangerous than an ounce thinly coating over the peritoneal surface.

Third. It is well known that patients with diffuse septic peritonitis stand a short operation well but a prolonged one badly; therefore, when all one's energy is directed to at once removing the cause of the peritonitis, and all other procedures except drainage eliminated, an operation can be speedily completed, on an average, perhaps in six or eight minutes. This naturally permits of a minimum amount of anæsthetic, thereby directly decreasing the chances of shock and vomiting after operation.

Fourth. The advantages of the Fowler position are so well recognized now that it only needs to be mentioned.

Fifth. Murphy's method of introducing large quantities of water into the rectum is novel. He inserts a nozzle containing three or four openings into the anus to which is attached a rubber tube leading to a bag. This bag is filled with water and elevated but a few inches above the plane of the rectum, the idea being that the water shall just trickle into the rectum not much faster than absorption takes place. In this way from a pint to a quart of water should be allowed to trickle in during an hour, the process being a continuous one and the flow so regulated that no accumulation of fluid takes place in the bowel. In other words, an attempt is made to run the water in as fast as it is absorbed. The object of having more than one outlet in the nozzle is that in case flatus accumulates in the rectum it will pass out through one of the openings in the tube while the others continue to discharge the water into the rectum. When it is desirable to stop the flow of water the tube is disconnected from the nozzle, the latter remaining in the anus, thereby avoiding irritation to the anus by the constant removal and insertion of the nozzle and at the same time facilitating the passage of flatus.

By this method large quantities of water will be absorbed within the first few hours after operation. This absorption does two things: First, It reverses the current of lymph in the peritoneal lymphatics so that instead of absorption taking place from the peritoneal surface the mouths of the lymphatics pour

out fluid, bathing the peritoneum with this free discharge. The posture, together with the action of the diaphragm, constantly sends this fluid downward to the pelvis, washing away the infectious material from the peritoneum in its descent, and escaping from the pelvis through the drainage tube. Second, The free absorption of the fluid from the rectum stimulates the heart and kidneys, and largely increases the amount of urine passed, eliminating through this channel the septic material which has gained entrance to the circulation. After the ordinary abdominal section in a non-septic case the average amount of urine secreted in the first twenty-four hours is perhaps 15 ounces, and in the presence of sepsis it is apt to be even less. In the first case that I shall report this evening more than 60 ounces of urine was secreted in the first twenty-six hours.

Sixth. Stopping all food and liquid by mouth will check peristalsis and prevent the dissemination of septic material by peristaltic movements. The absorption of large quantities of fluid by rectum is quite sufficient to sustain the patient for forty-eight hours or more, but if the condition of the patient is so precarious that food seems a necessity, small quantities of it can be run into the rectum with the water.

As an example of the results obtained by this method let me relate briefly the histories of two cases; one representing the fulminating type of perforating appendicitis in which perforation takes place within a few hours after the onset of the first symptom, without protecting abdominal adhesions: the other a case of walled-off appendiceal abscess in which the abscess had ruptured into the general peritoneal cavity, where no adhesions were present.

CASE I.—A small, pale, thin married woman, aged 26, was admitted to the Bryn Mawr Hospital at 11 A.M., October 11, while in her third attack of appendicitis. The attack began the previous day at 8 P.M., with sharp abdominal pain, which gradually became agonizing, but which was suddenly much relieved at 4 A.M., the estimated hour of perforation of the appendix.

On admission the temperature was 100 2-5; pulse 112. An hour and a half after admission an incision was made through

the right rectus, and immediately on opening the peritoneum there was an escape of a considerable amount of purulent fluid with shreds of lymph floating in it. The appendix was ruptured, partially gangrenous and bound down at its base by rather old adhesions, but the remainder was without adhesion to the surrounding viscera. There was a general diffuse peritonitis, (no attempt at walling off), with occasional patches of lymph coating the intestines, while the head of the cæcum was much inflamed, intensely red and the peritoneum had lost its glistening character. The appendix was removed, a puncture made through the abdominal wall in the median line two inches above the pubis for the admission of a drainage tube which led to the bottom of the pelvis. Another drainage tube was inserted through the operative wound leading to the right iliac fossa, while the remainder of the incision was filled with loose gauze. No sutures were used. The duration of the operation was six or seven minutes.

The patient was placed in bed in the Fowler position and the rectal enema at once begun. During the first twenty-four hours the patient received 12½ pints of salt solution through the rectum, not more than 6 or 8 ounces of which was expelled. The temperature ranged from 98 to 99⅗, and the pulse came down to the 80's. She had a fairly comfortable night after ⅙ gr. of morphia had been given hypodermically. During the first twenty-four hours the abdominal dressings had to be changed twice owing to their complete saturation with a colorless fluid of a slightly sour odor, and in the first twenty-six hours 65 ounces of urine were passed. On the third day a little water was given by the mouth for the first time, and from then on the fluids were rapidly increased. The rectal enemas were stopped at this time. No purgatives were given and on the fifth day the bowels moved twice naturally. The remainder of the convalescence was uneventful, the temperature and pulse remaining normal.

CASE II.—An Italian aged 37 was admitted to the Bryn Mawr Hospital October 14, having been sick five days. The attack started with severe general abdominal pain and nausea. The pain shortly localized itself in the appendix region, and previous to admission he had two chills, with fever and sweats.

On admission temperature was 102⅖; pulse 120; respirations rapid; tongue dry; general appearance of typhoid condition.

The abdomen was opened through the right rectus and an appendiceal abscess was found, which had ruptured into the general peritoneal cavity, the pus welling up through the incision with each respiration. A gangrenous, perforated appendix was removed, and the drains arranged as in the previous case without sponging the peritoneum or even removing the excess of pus which was flowing from the wound. The operation lasted about seven minutes. While on the operating table his pulse was recorded at 200.

During the first ten hours 9 pints of salt solution were given by rectum, about a pint of which was not retained. Temperature dropped to 98⅘ and the pulse varied from 100 to 80. He passed 900 c.c. of urine during the first thirty hours. As in the previous case nothing was given by mouth until the third day, when water was begun and the fluids rapidly increased. On the third day, without purgatives, the bowels moved twice. The rest of the convalescence was uneventful.

These two patients recovered without a single untoward or alarming symptom. The rapid falling of the temperature and pulse to normal; the absence of further septic absorption; the free elimination through the kidneys of toxic material; the absence of distention, nausea and vomiting, etc., lead me to believe that the favorable termination was directly due to the method practised.

EXTROVERSION OF THE BLADDER.

RELIEF BY TRANSPLANTATION OF THE BLADDER INTO THE RECTUM.

BY B. G. A. MOYNIHAN,

OF LEEDS, ENG.

In cases of extroversion of the bladder, no operation met with any noteworthy success until the work of Petersen had shown that by preserving the valvular termination of the ureter in the bladder, the transference of the ureters into the intestine was capable of being successfully accomplished. The most satisfactory application of this knowledge was made by Peters of Montreal. The old plastic operations of Wood and Ayres made the patients possibly a little more comfortable, but did nothing to relieve a condition which they, as well as their neighbors, felt to be revolting.

On March 11th, 1905, I was asked by Dr. Empey, of Cross-hills, Keighley, to see a youth, J. B., aged nineteen, who fifteen years before had had a plastic operation performed for extroversion of the bladder. Flaps from the lateral aspects of the abdominal wall had been turned over to the middle line until a sort of bridge had been formed over the upper part of the exposed mucous surface. The lower part of the bladder mucosa, however, that which bore the ureters, was still exposed, and urine therefore escaped on to the surface of the abdomen. It was there caught in the usual rubber receptacle, of pestilent odour, and drained downwards to the leg. The patient, with increasing years had become more painfully aware of the misery of his condition and begged to have something, anything done to relieve him of his terrible affliction.

On examining him I realized at once that the upper part of the bladder mucosa was healthy; that it might be preserved. I therefore decided not to transplant his ureters, but to transplant

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On admission temperature was 102⅖; pulse 120; respirations rapid; tongue dry; general appearance of typhoid condition.

The abdomen was opened through the right rectus and an appendiceal abscess was found, which had ruptured into the general peritoneal cavity, the pus welling up through the incision with each respiration. A gangrenous, perforated appendix was removed, and the drains arranged as in the previous case without sponging the peritoneum or even removing the excess of pus which was flowing from the wound. The operation lasted about seven minutes. While on the operating table his pulse was recorded at 200.

During the first ten hours 9 pints of salt solution were given by rectum, about a pint of which was not retained. Temperature dropped to 98⅘ and the pulse varied from 100 to 80. He passed 900 c.c. of urine during the first thirty hours. As in the previous case nothing was given by mouth until the third day, when water was begun and the fluids rapidly increased. On the third day, without purgatives, the bowels moved twice. The rest of the convalescence was uneventful.

These two patients recovered without a single untoward or alarming symptom. The rapid falling of the temperature and pulse to normal; the absence of further septic absorption; the free elimination through the kidneys of toxic material; the absence of distention, nausea and vomiting, etc., lead me to believe that the favorable termination was directly due to the method practised.

EXTROVERSION OF THE BLADDER.

RELIEF BY TRANSPLANTATION OF THE BLADDER INTO THE RECTUM.

BY B. G. A. MOYNIHAN,

OF LEEDS, ENG.

In cases of extroversion of the bladder, no operation met with any noteworthy success until the work of Petersen had shown that by preserving the valvular termination of the ureter in the bladder, the transference of the ureters into the intestine was capable of being successfully accomplished. The most satisfactory application of this knowledge was made by Peters of Montreal. The old plastic operations of Wood and Ayres made the patients possibly a little more comfortable, but did nothing to relieve a condition which they, as well as their neighbors, felt to be revolting.

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his whole bladder, or so much of it as the operation might show to be vascular enough to transplant, into his rectum. It occurred to me that if a large area of the bladder could be grafted, so to speak, into the rectum, that the capacity of the bowel would be increased, and a veritable cloaca formed. My only doubt was that the vascular supply furnished along the ureters might be insufficient for a large area of the bladder. But in the operation I now describe I found that, when the edges of the bladder were trimmed with scissors, a free oozing of blood occurred from the cut surface. I therefore was able to transplant the entire bladder. The following are the details of the operation:

Operation.—The ureters were first catheterised. (Fig. 1.) Owing to the previous constant friction against the exposed bladder mucosa, which pouted exuberantly, this little manœuvre was by no means easy. A catheter was passed for 4 inches into each ureter and was fixed there by a single stitch which caught up the tube on one side and the bladder on the other. A vertical median incision was then made from the exposed bladder mucosa towards the umbilicus, the flaps which had been turned over to the middle line in the previous operations being completely cut through. On turning aside the flaps thus made the upper, previously covered, mucous surface of the bladder was exposed; it was found to be smooth, thin and entirely different in character and appearance from that of the lower exposed part. An incision all round the margin of the mucous membrane of the bladder was now made, between the mucosa and the skin, and the incision was deepened by degrees until a good thickness of the bladder could be raised up. The dissection from the margin of the bladder towards the ureters was continued, round the whole circumference, little by little. This was difficult in part owing to the fact that there was much scar tissue left from the former operations, in part because the great vascularity demanded frequent cessation to restrain the hæmorrhage by pressure. The separation above the pubes was most difficult, and here the prostate had to be separated with great care.

The purpose of this process of separation was to isolate the whole of the bladder, leaving only as its pedicle, so to speak, the two ureters. As much tissue was left round each ureter as possible, so as to avoid the possibility of damage either to the
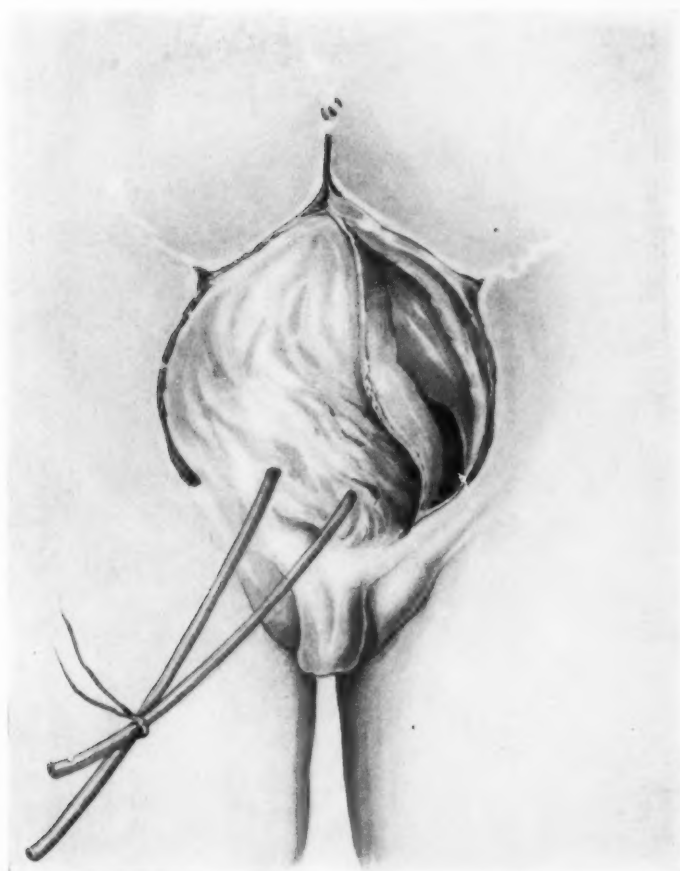
FIG. 1.—Catheterisation of the Ureters.   The Scars of the former flap operations
are visible.

FIG. 2.—The Bladder Separated (in the actual operation, the ureters were not stripped so much as in the figure).
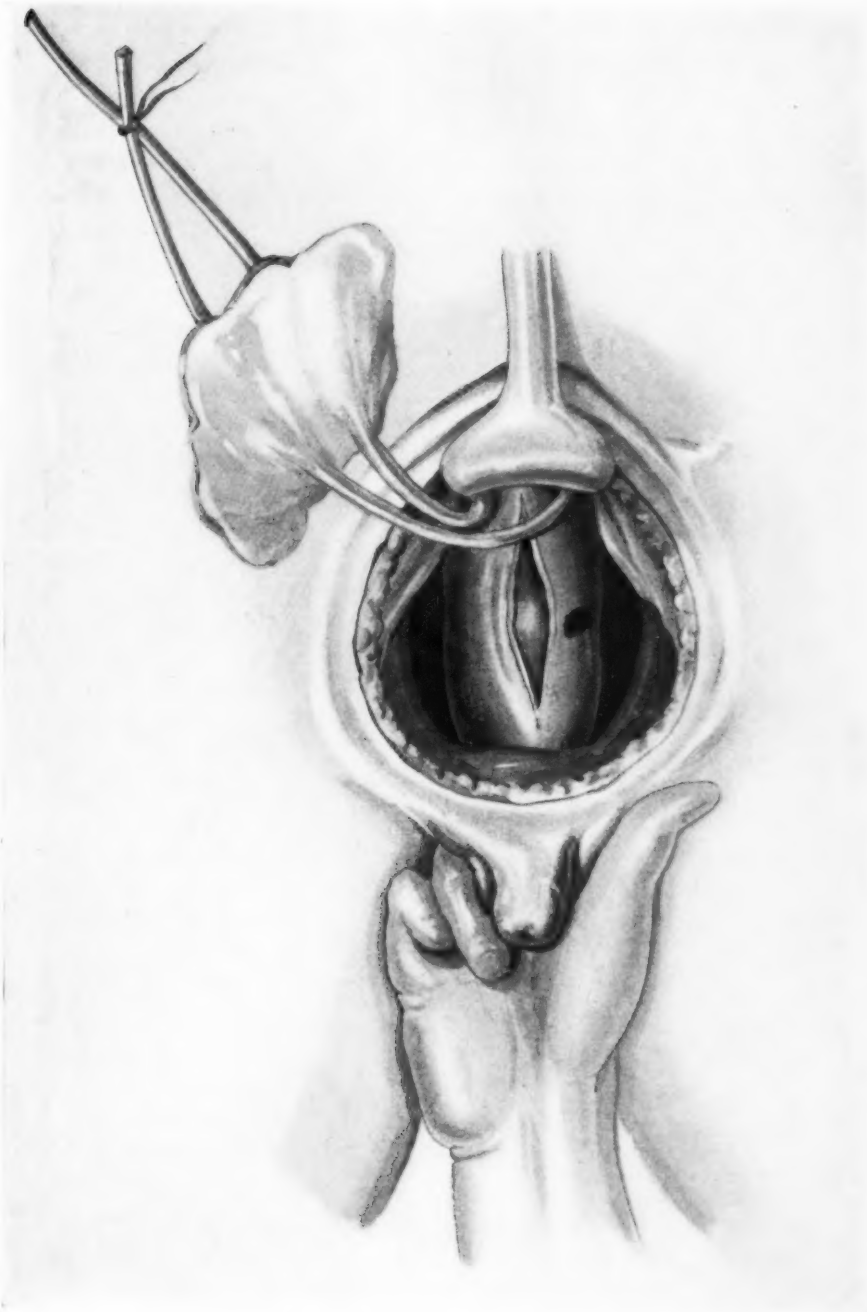
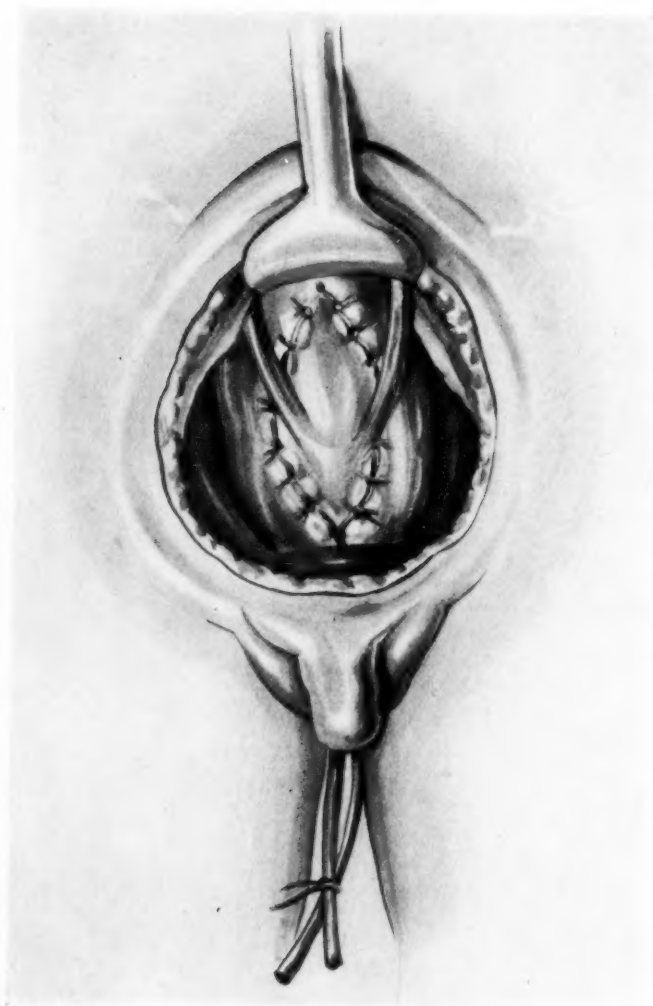FIG. 3.—The return opened ready for the transplantation of the bladder.

FIG. 4. –The transplantation completed.

ureter itself or to its vessels.   In the annexed diagram (Fig. 2.) the ureters are shown clearly defined.   This was not their condition during the operation; the figure is so drawn only for the purpose of making the details of the operation clear.   As soon as the bladder was well isolated it was drawn upwards towards the umbilicus and there held by an assistant.   In the bottom of the wound the rectum was now seen, and, above, the peritoneal reflection on to it.   The serous covering was then stripped upwards from the front of the rectum until 4 or 5 inches of the bowel lay exposed at the bottom of the wound.   In stripping the peritoneum up, a small rent was made into it, which was closed at once by a continuous catgut suture.

The finger of an assistant was now passed into the rectum to make it prominent, and along the anterior surface of the bowel an incision about 3½ inches in length was made.   (Fig. 3.)   The upper and lower ends of this incision, and the mid-points of the sides were held with small vulsella, until a large opening was made.   Into this opening the bladder was placed, being turned upside down so that its former anterior surface became posterior, and its former lower end became the upper.   The ureters instead of passing forward to the bladder passed backward and the catheters passed into the rectum and out at the anus.   The edge of the bladder and the cut edges of the rectum were now sutured together, by two stitches that were continuous, one taking the right side, and the other the left.   (Fig. 4.)   The sutures were passed after the manner of Lembert so that no mucous membrane was included in them.   A few additional interrupted sutures were necessary here and there.

When the sutures seemed to be securely uniting the bladder and the rectum, the wound was dried and the skin edges along the original median incision were drawn together.   At the upper end, the edges came well into apposition but about an inch at the lower part had to be left open.   The catheters which had been introduced into the ureters now passed out of the anus; the sphincter had previously been stretched.   The operation lasted an hour and a half.

The after progress of the case was satisfactory.   The catheters remained in the ureters for four days, the urine being collected into a bottle.   After their removal urine passed into the

rectum and dribbled out at the anus, which, owing to the stretch-
ing of the sphincter, as yet exerted no control.   On the seventh
day, a little urine began to leak by the abdominal wound, and this
continued for a week.   On the fifteenth day an anæsthetic was
again administered, and the leaking point in the former line
of suture discovered, and made good.   From this day the wound
remained absolutely dry, all urine escaped by the rectum and
control gradually returned until at the end of a month it was
perfect.   Urine was then passed by the rectum about every two
hours.   The interval between the acts of emptying the rectum
has gradually increased until now (Nov. 1905) the shortest
period is three hours and the longest five hours.   The urine is
quite sweet and is normal on examination.

When the rectum is now examined the line of junction
between the mucous membrane of what was the bladder and the
mucous membrane of the rectum cannot be distinguished.   All
feels smooth and even and continuous.   There is a fairly capac-
ious cloaca.

NOTE.—The accompanying drawings were kindly made for me by Miss
Ethel M. Wright.

TWO CASES OF RUPTURE OF THE BLADDER.

BY JOHN MARNOCH, M.B., C.M.,

OF ABERDEEN,

Surgeon to and Lecturer on Clinical Surgery at the Royal Infirmary of Aberdeen.

WITHIN recent years valuable papers have been published on intraperitoneal rupture of the bladder, notably by Alexander and Jones in THE ANNALS OF SURGERY, and from a review of the published cases some definite conclusions have been arrived at as regards the mechanism, clinical features and results of treatment of this rare accident. Since MacCormac, in 1886, published the first two cases successfully operated upon quite a number have been put on record and it is now quite clear that the prognosis with the advance of surgical technique is becoming more and more favorable. Thus, Jones in the fifty-four cases collected by him showed that the death-rate was forty-eight per cent. but that twenty-two of these fifty-four cases occurred during the last ten years and in them the mortality was only twenty-seven and a half per cent. This is all the more striking a tribute to surgical progress when it is borne in mind that the average time between the accident and the operation was longer in them than in those occurring previous to ten years ago. Two cases of rupture of the bladder have come within my experience and it has been thought desirable to add these to the few recorded since the publication of the papers mentioned above.

CASE I.—*Intraperitoneal and Extraperitoneal Rupture of the Bladder—Suture—Recovery.*—J. M., fifty-two years of age, by occupation a shipwright, was admitted to the Royal Infirmary, Aberdeen, on the 10th March, 1903, with the following history: At 1 P.M. on the previous day while ascending stairs he fell and struck the lower part of his abdomen on the edge of one of the steps. His complaint was that from the time of his accident he

had had pain over the region of his bladder and inability to pass urine. There was no sign of external bruising but the lower part of the abdomen was somewhat distended especially in the median line and on percussion the whole lower abdomen from about one inch below the umbilicus was dull as also were the flanks. Dr. Robertson, my house surgeon, passed a catheter without meeting any obstruction and drew off about three ounces of apparently normal urine, followed by a few drops of blood. As no relief was experienced the patient was once more catheterised, but this time no urine came away at all and as the pain and desire to micturate were still complained of and no difference was to be detected in the percussion dulness already referred to he was put to bed. Catheterisation after a lapse of two hours again brought away about two ounces of urine, followed by some blood. Dr. Robertson then resolved to try the injection test, and accordingly 13½ ounces of warm boracic lotion were run into the bladder by catheter, tube and funnel under strict antiseptic precautions and only four ounces could be withdrawn subsequently. Patient's temperature was 98° and his pulse was 96, occasionally slightly irregular but of good volume. He had no appearance of collapse or shock. A diagnosis of intraperitoneal rupture of the bladder was made and I was sent for with a view to operation.

Operation at 1.25 p. m., rather over twenty-four hours after the accident. An incision was made in the median line from the pubes upwards and the prevesical space opened first. From this region some blood-stained urine escaped from a small irregular tear just behind the pubes. Through the peritoneum fluid could be felt in the peritoneal cavity, which was accordingly opened and a large amount of blood-stained liquid escaped. With the exception of slight congestion of the intestines at the lower part of the abdomen there was no trace of peritonitis. The peritoneal cavity was mopped clean and an examination of the bladder instituted, when a small tear was found in the median line just behind the peritoneal reflection. The rupture of the viscus extended from just behind the pubes along the top to a point behind the peritoneal reflection referred to. This rupture had not penetrated the whole thickness of the bladder wall except at its two extremities. The extraperitoneal rupture behind the pubes was with great difficulty surrounded by a purse-string suture which was

then buried by a series of interrupted Lembert sutures. The intraperitoneal rupture was closed by a double row of Lembert sutures without difficulty. The abdominal cavity was thereafter mopped dry and after flushing copiously with sterile salt solution the peritoneum was completely closed as was also the rest of the abdominal wound except at the lower part where tube and gauze drainage leading down to the extraperitonal rupture was employed. A soft rubber catheter was introduced per urethram into the bladder and tied in.

About 15 ounces of urine were passed by catheter during the rest of the day, but some came by drainage through the lower angle of the abdominal wound. The following day less came by catheter and more suprapubically, as his catheter was frequently found partially withdrawn from the bladder. In the evening his temperature rose to 101°F. and the patient began to show signs of delirium tremens. After a very restless night his temperature came down almost to normal and during the following day 35 ounces of urine came by catheter and very little suprapubically. This went on, sometimes a good deal coming by catheter and less the other way and *vice versa,* when it was discovered that the patient had been attempting at intervals to remove the instrument from his bladder from a few hours after the operation and eventually on the fourth day, he succeeded in extracting it altogether and absolutely refused to have it replaced. His restlessness and delirium never became violent and in five or six days disappeared. The subsequent history is that the suprapubic wound gradually closed and in ten days all his urine was passed per urethram. He was discharged well exactly a month after operation.

About this case there are many points of interest, but the chief are: In the first place, the extraperitoneal and intraperitoneal ruptures were not distinct and separate from each other but were simply the extremities of a median rupture in the vault of the bladder which had not in the rest of its course completely penetrated all the coats. Then, again, in dealing with an intraperitoneal wound of the bladder the safest practice after suturing is undoubtedly to pass a drain for a few days down to the neighborhood of the suture, but

here the circumstances were exceptional. I felt I could count almost to a certainty on the sutures of the intraperitoneal wound holding, but could not do so in the case of those of the extraperitoneal wound on account of the difficulty I had in getting them placed behind the pubes. Leakage from the latter, had intraperitoneal drainage been employed, would probably have infected the former and ended in disaster. The subsequent behavior of the patient in withdrawing the eye of the catheter from his bladder leading to distention of that viscus and leakage from the suprapubic wound proved the wisdom of the procedure adopted. The absence of peritonitis is noteworthy and once more explodes the old idea that peritonitis is set up as soon as urine escapes into the peritoneal cavity. In this case it was evidently due to the aseptic condition of his urine.

CASE II.—*Extraperitoneal Rupture of the Bladder and Hydatid Cyst of the Abdomen—Operation—Recovery.*—Mrs. M., forty-one years of age, was admitted to the Royal Infirmary, Aberdeen, on the 18th March, 1904, at 11.45 P.M. She stated that at 9 A.M. on the previous day she had fallen a height of ten feet, alighting on the left side of her pelvis and back and that since that time she had had continuous pelvic pain with frequent desire to urinate and the passage of very small quantities of blood-stained urine. She looked flushed and feverish, her temperature being 100°F; pulse of fair quality, 104, and respirations 20. On account of the pelvic pain she was unable to turn on her side. Her abdomen was moderately distended and did not participate in the respiratory movements. There was general tenderness with loss of resonance in the flanks and bladder region and tympanitic note elsewhere, while the liver dulness was completely abolished. Tapping the iliac crests produced slight crepitus and aggravated the pelvic pain. No abnormality could be made out on vaginal and rectal examination. Catheterisation of the bladder brought away eleven ounces of dark blood-stained urine and on trying the injection test the full quantity was recovered. About an hour after admission she vomited some bilious material.

It was evident from the condition of the abdomen that an intraperitoneal injury had occurred, but the exact nature of it I

could not determine. While extraperitoneal rupture of the bladder was thought probable, an intraperitoneal rupture, although not absolutely negatived by the injection test, was rendered less likely.

Operation 2 A.M. on the 19th March, forty-one hours after the accident. The prevesical space was first explored but no sign of rupture could be made out, and accordingly the peritoneal cavity was opened. After mopping out a quantity of blood-stained fluid a careful but fruitless search was instituted for injury to any of the contained viscera. The frequency of micturition with the passage of very small quantities of blood-stained urine pointed to a bladder injury, and in case a small intraperitoneal rupture had escaped observation I caused the organ to be distended with warm boracic lotion. It was then seen that the rupture was extraperitoneal, the injected fluid coming welling up from behind the pubes, but the site of the injury was so inaccessible that no attempt was made to apply sutures. There still remained the difficulty of accounting for the blood-stained fluid in the abdominal cavity so, once more, the viscera were systematically explored and at length a cyst was discovered lying retroperitoneally behind and rather to the outer side of the ascending colon, reaching from the cæcum below to the front of the right kidney above. This was enucleated by an incision through the peritoneum to the outer side of the large intestine and was found to be oval in shape, six inches long and three in diameter, with very thin gauzy looking walls and containing a clear limpid fluid. No further abnormality could be made out and the abdominal cavity was flushed with sterile salt solution and the wall closed except at its lower angle, where gauze drainage of the prevesical space was established. A flexible catheter was passed per urethram into the bladder and the patient sent back to bed.

Her subsequent history is that the blood-stained urine soon became clear, while the retropubic urinary fistula gradually closed, convalescence being retarded by the occurrence of some suppuration in the left labium and adjacent adductor region. She left the Hospital on the 18th July, 1904, quite well. Histological examination of the cyst proved it to be a hydatid. The patient was at first too ill to have a skiagram of the pelvic bones taken to show the site of the fracture and unfortunately this was omitted before her dismissal.

As in the other case, both an extraperitoneal and intra-peritoneal injury occurred as the result of the fall. What the intraperitoneal lesion was is obscure, but a reasonable hypo-thesis seems to be that there existed in the abdomen another cyst similar to the one discovered, but which had ruptured at the time of the accident, the contained fluid escaping into the peritoneal cavity and setting up irritation with effusion. Assuming that the wall of the ruptured cyst was of the same thin, gauzy nature as the other, it cannot be wondered at that, when collapsed, it escaped detection. The combination of fractures of the pelvis in this case with extraperitoneal rupture of the bladder and the absence of fracture in the intraperitoneal case is in conformity with the general rule.

LOOSE BODIES IN THE KNEE JOINT.

WITH REPORT OF CASES.

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THE Corpora Libera Articulorum, the Corpora Mobilia, the Mures Articuli, the Gelenkmaus, of the Germans; the Corps Etranger Articulaires, of the French, and the Loose or Floating Bodies of the English, have been classified into: *a*, Those in normal joints, or if the joint is diseased, this disease is the result of the presence of the floating body; *b*, those in pathological joints, being the result of such pathology.

But in many cases it has been difficult, if not impossible, to accurately determine with which of these subdivisions a certain body should be classed. In consequence, they have been divided, more practically, according to their composition, as follows:

1, Those consisting of foreign material, fatty tissue, fibrous tissue, fibrin, etc. 2, Those composed of bone, cartilage, or a combination of these two.

A transition of these bodies from class 1 to class 2 has been suggested, and undoubtedly this change does take place.

In class 1, perhaps the most important are the "Rice Bodies," "Melon Seeds," and the "Corpora Orysoidea," which as a rule indicate the tubercular nature of the change. These bodies occur not only in joints, but in tendon sheaths, and bursae, most frequently in regions other than the knee. They vary in size from $\frac{1}{4}$ to $\frac{1}{2}$ inch in diameter, and in color, appearance, and consistency resemble boiled rice. Histologically they are found to be composed of fibrin and are practically structureless. They are supposed to be formed, by the exfoliation of particles of necrotic tissue, by a separation of villous or papillomatous growths from the

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synovial membrane, followed by coagulation necrosis, or by the fibrinoplastic properties of the tubercle bacilli by which granulations are converted into fibrous tissue.

The lipomata in connection with the knee joint have recently received attention that has evidently been long due them, by numerous writers and especially by Hoffa [1] in his paper before the American Medical Association in 1904. In the cases reported in this contribution to the subject the bodies were of either bone or cartilage, and therefore the discussion will be limited to those bodies coming under that class.

According to Mueller,[2] Ambrose Pare, of ligature fame, in 1558, was the first to remove a loose body from the knee joint although its presence was unsuspected until the joint was opened for the purpose of draining an abscess. This particular body happened to be of cartilage, and hence the frequent use of the name " floating cartilage," many times regardless of its histological structure. In 1691, Pechlin was the first to describe the symptoms accompanying this condition. Subsequently cases were reported by Monro in 1726, Simpson in 1736, and by Morgagni in 1746, after which they were no longer considered a rarity.

In 1793 John Hunter [3] considered these bodies at length, and theorized upon their formation in a paper read by Sir Everard Home, and published in Hunter's work entitled " The Blood, Inflammation and Gunshot Wounds." An unusual case is cited in which many such bodies were found in a pseudo-articulation following a non-union of the humerus. He then attributed their origin to the presence of small coagulæ of blood in the joint.

Rainey and Solly [4] in 1848 presented theories as to the formation of these floating substances within the joint. After a careful examination of the bodies and the lining membrane of the joints, they conclude that the glands of the synovial membrane instead of secreting synovia, under some influence, produce cartilage instead, which becomes converted into imperfectly formed bone.

Since then many theories have been brought forward to explain the presence and the formation of such bodies, and

even at the present time these points are not definitely known. Among the following will be found the usual explanations:

a.   A dry arthritis with an overgrowth of the margins of the articular cartilages.

b.   Bony growths that have broken away from their attachments.

c.   Infarction of the articular cartilage, with final separation of the infarct.

d.   Plate of bone formed outside of the joint and then invaginated.

e.   Chondrification and calcification of enlarged synovial villi.

f.   An irritation and growth of embryonal cartilage and bone cells in the synovial fringes.

g.   Concretions similar to biliary or cystic calculi, the nucleus being either a blood clot, a torn synovial fringe, a foreign body, a lipoma, or a piece of articular cartilage.

h.   A portion of articular surface or semilunar cartilage broken off by direct injury.

i.   A portion of articular surface or semilunar cartilage damaged by trauma, and subsequently becoming separated.

Trauma is considered by many authorities, notably by Barth,[5] and by Vollbrecht,[6] to be the cause of these bodies, but some observers, such as Sir George Humphry,[7] doubt that they are ever caused by traumatism. It is certain that in many cases a history of injury is quite doubtful and in some instances absolutely negative.

Various experiments have been undertaken to determine the relationship existing between these bodies and a previous injury to the joint. Kragland[8] found that upon the cadaver it was impossible to detach a fragment of articular cartilage simply by a blow; an area was loosened in this manner, but in order to separate it, a prying force had to be applied. Codman[9] in a series of similar experiments arrived at the same conclusion.

But Burghard[10] in 1892 found that an oblique blow upon the internal condyle, with the knee flexed, may, with some difficulty, cause a complete separation of a piece of the articular cartilage.   Cornil and Coudray[11] in experimenting upon

dogs found that these bodies of traumatic origin became
united to the articular extremity of the bone or to the syno-
vial membrane. In one case eight days after the separation
of a fragment of the articular surface of the bone, with
chisel and mallet, this piece was found united to the condyle
by an osseous bridge. H. Rimann [12] found the same result
after conducting similar experiments upon goats and dogs.
These experiments show that the influence of trauma in caus-
ing the formation of these joints is still *sub judice.*

The experiments of Kraglund and of Codman tend to
substantiate the explanation offered by Koenig,[13] *i.e.,* the
traumatism injures and depresses a certain portion of the
articular surface, and that this portion subsequently becomes
detached by a pathological process, a fatty necrosis, called by
Koenig " Osteochondritis dessicans."

Sir J. Paget [14] described practically the same process
and called it " Quiet Necrosis." Mr. Teale,[15] at about the
same time, mentions the same condition but without giving it a
special name. Other names that have been applied are " Spon-
taneous demarcation," by Klein,[16] and " Ostitis," by Kraglund.

Poulet and Vaillard,[17] after a very complete and exten-
sive study of this subject, arrive at practically the same
conclusion relative to traumatism as an indirect etiological
factor.

M. L. Harris,[18] in discussing this explanation after
drawing attention to the fact that Koenig's paper was written
fifteen years ago, said: " There is almost no one who reports
a case that does not reach the conclusion that Koenig was
wrong." Still we find that Grüder [19] has recently reported
a case under the title " A Contribution to the Origin of
Free Joint Bodies through Osteochondritis Dessicans of
Koenig." Martens[20] makes an extensive report from Koenig's
clinics at Gottingen and Berlin, including clinical and opera-
tive histories with microscopic examinations of the bodies
removed. And in the present year, Koenig[21] himself strenu-
ously supports his previous position in a reply to the experi-
ments and writings of Rimann and Cornil and Coudray.

In the absence of a positive history of injury the
frequent occurrence of this condition in both knees, while

not excluding traumatism, does seem to render such an explanation less plausible. Bowlby,[22] Clutton [23] and Weichselbaum [24] each records cases in which a loose body exactly similar in shape, size and position was found in the knee joints of both limbs. Bennett [25] explains the not uncommon involvement of both joints, as being due to the sprain or sudden twisting of the second joint which frequently takes place in the constant effort, made unconsciously, to protect or favor the joint first affected.

That these floating bodies of the joint are rarely of purely traumatic origin, was shown by Halstead,[26] who in 1895, after a careful review of the literature, found only three cases of this character, and one of these was doubtful. Koenig, Bruns, and many German authorities claim that spontaneous traumatic separation never occurs. But Burghard [10] reports one undoubted case of this character and, while admitting their extreme rarity, mentions five similar ones that he collected from the literature.

Max Schüller [27] collected 143 cases of floating bodies in the joints and found that 85 were of distinctly traumatic origin, 39 were due to pathological changes, and 19 were unknown. But in these the question as to the direct traumatic separation of the fragment is not entered into. In many instances it is extremely difficult to determine the role played by traumatism. The movable body may lie dormant and not until there has been some injury to the knee do the symptoms present themselves. Or, in accord with Koenig, the osteochondritis dessicans may have all but separated the particle of articular cartilage when a comparative slight trauma completes the work.

The presence of a defect in the articular surface, approximately equal in size to the floating body, has been frequently noted. Instances beautifully illustrating the origin of these bodies from such defects are related by Codman [9] and Lane.[28] Harris [18] mentions a case in which the floating body accurately fitted into the defect, and the history of the case extended over thirty-two years.

The defect is usually situated on the internal condyle, because when the knee is flexed the patella does not protect

this in so complete a manner as it does the external con-
dyle. But the external is sometimes injured, and MacCor-
mack [29] mentions the case of Bruce Clark, in which the defect
was on the articular surface of the patella. A discrepancy
in the size or shape may exist between the body and the
defect. This may be explained by a partial or beginning
regeneration of the articular surface, or by a change in size
of the detached fragment. Usually both of these factors
will have been responsible for the lack of symmetry between
the two.

The defect may be absent, owing to the origin of the
body from some other source, or to a complete regeneration
of the articular surface (as in Case II).

In a case reported by Wilson [30] in which he removed
the body one year after the injury, critical examination of the
condyles of the femur was negative, but on the posterior
internal portion of the articular surface of the tibia, there
seemed to be an irregularity which led to the surmise that
this point was the origin of the body removed. Subsequent
repair had largely obliterated any cavity that might have
been made at the time of the accident.

This loss of substance in the articular surface of the
bone even if corresponding, in size and shape, to the loose
body does not necessarily mean that the latter originated
from the former. Halstead [26] has brought out the point that
the free body may possibly originate from some other source
and then by pressure atrophy cause a depression in the arti-
cular surface, similar in size and shape to the movable body.
In the case of Fairchilds [31] a bullet was removed from the
knee joint after having been in the joint or its neighborhood
for many years. The foreign body had worn a groove into,
but not through, the articular cartilage.

The history of these fragments after separation is another
subject of much speculation. That they increase in size can not
be doubted. Cornil and Coudray [11] mention two fragments
that measured 7 mm. and 8 mm. in their longest diameter,
but which measured 12 mm. and 13 mm. at the end of 1 and
1½ months. This augmentation in size they attribute some-
times to the production of fibrous tissue and sometimes to the

formation of new fibro-cartilage. Other explanations are that the increase in size is due to imbibition from the synovial fluid, to the deposit of layers of fibrin from the synovia, or to the deposit of lime salts. Poulet and Vaillard [17] have shown that the fragment which at the time of its origin consists of bone and cartilage, becomes surrounded on all sides by cartilage, and that this newly-formed cartilage differs from the articular cartilage in being more embryonal and irregular.

In Wilson's [30] case the bone removed was found to have two surfaces covered with cartilage. The firm attachment to the tibia, and its vascularity, indicated to Wilson that it had formerly been much smaller.

Codman [9] points out that the growth is chiefly in the cancellated bone, which may at times completely surround the cartilage, and in many cases that the cellular elements are still capable of being stained, which seems to point toward the activity of the osteoblasts. But to show that this power of the bone has not as yet been definitely determined we quote Codman; "A priori, however, one would think that growth by concretion and the slow deposit of lime salts would be more likely."

Cornil and Coudray [11] claim that one of the first changes noticed in all the traumatic foreign bodies was a disappearance, more or less rapid, and more or less complete, of the living cells of the bony portion of the fragment. Where there has been noted a reproduction of either the osseous or the cartilaginous cells the nutrition for this growth has been supposed to be derived from the synovial fluid. Barth [5] thinks that the necessary nutriment is supplied through adhesions to the capsule. The pedicle, when present, has so often been found to be non-vascular, that a source of blood supply from this attachment is not to be expected Yet Barwell [32] thought that many of these bodies originated outside of the joint proper and likens the pedicle to a mesentery.

Blood-clots have undoubtedly become impregnated with calcium salts, and foreign bodies have been surrounded by osseous or cartilaginous material. For example, in the case of Shaw [33] the loose body was found to have, as a nucleus, a fragment of a needle. In this conection, Fairchild's [31] case

is interesting, A Minié ball weighing 440 gm. was removed from the knee joint twenty-nine years after receiving a gunshot wound, but only three or four years after the onset of definite symptoms referable to the knee. In a personal communication Dr. Fairchild states that the ball was not covered with a deposit, neither was it bright, but of a dull, dead color.

The number of bodies that have been found within the joint varies greatly. They may be single or multiple and so frequent are they multiple that others should always be searched for. Bland Sutton [34] counted 1532 calcareous granules that were removed from a shoulder joint. Berry [35] removed 1047 from a knee joint from which, four years previously,[36] he had removed 50; he also mentions a case in which Mr. Thomas Smith removed 400 movable masses of cartilage from a knee. Barwell [32] states that nine tenths of these bodies occur in the knee joint, with the elbow being the next frequent site, and Barth,[5] in his classic work entitled " The Origin and Growth of Free Joint Bodies," found reports of cases in the knee, 55; elbow, 8; shoulder, 2; and wrist, 1. Paget [14] mentions a case of the hip joint, and the articulation of the lower jaw has also been found involved. The ankle is rarely affected, but even pseudo-articulations are not exempt, as was seen in the above mentioned case of John Hunter's.[3]

Symptoms.—The symptoms may be very marked, significant, and to a degree almost pathognomonic. The most characteristic symptom is undoubtedly the sudden occurrence of severe sharp shooting pains in the joint, frequently so severe as to cause syncope. And with this pain there is a " locking " of the joint, *i.e.*, an inability to flex or extend the limb. The leg is usually slightly flexed, which is perhaps due to the interposition of the floating body between the articular surfaces, or between the bone and the capsular ligament. Reichel [37] is of the opinion that the body is never caught between the joint surfaces themselves, and cites the case of Lawson in which operation was performed during the attack, and the body was found in this position. In Case I of this series the operation was performed while the joint was locked and the body was found between the capsule and the joint surface. (See Fig. i).

In Case IV (Fig vii) the movable cartilage seemed to occupy a relatively similar position, yet at no time was there locking of the joint. In this case the exact relations of the body were not determined by operation; the body may have been external to the capsule, possibly passing through a tear in the capsule at the time of the injury.

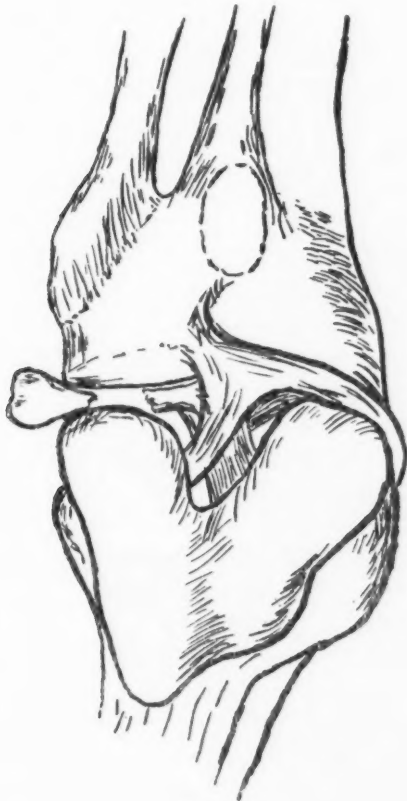The larger the body, the less acute are the symptoms,

FIG. 7.

although in cases where the large body exists the attack of pain, while not so severe, is more continuous. This is well shown in Case III, in which the bodies are extremely large. The pain had increased with the increase in size though a locking with its accompanying paroxysm had not occurred in many years.

The locking may last for a variable time, from an instant to a day or two. An acute synovitis usually follows and may persist for a number of weeks. Occasionally the synovitis may be absent, if the locking has been of very short duration. These attacks occur at irregular intervals and generally during the interval the joint is approximately normal.

With the presence of a palpable mass in the joint, or in connection with the joint, the above symptoms will lead to an accurate diagnosis, but on the other hand, with the absence of any visible or palpable mass in the neighborhood of the joint, differentiation from the other causes of " Internal Derangement of the Knee " will be arrived at only with great difficulty, if at all.

The different pathological conditions that may be included under the caption " Internal Derangements " have been classified, according to their frequency, by Tenny [38] as follows: Tabs from lubricating apparatus; Erosion of cartilage; Damaged and displaced semi-lunar cartilages; Ruptured ligaments; Free and loose bodies; Villous and papillary synovitis.

Damaged or displaced semi-lunar cartilages are perhaps the most frequent condition confused with the free or loose bodies. This condition was first described by Hey,[39] of Leeds, England, in 1803, and was called " Hey's Internal Derangement of the Knee." It was treated by splints, supports* and appliances. In 1885 Mr. Annandale,[40] of Edinburgh, followed closely by A. W. Mayo Robson,[41] of Leeds, operated for the relief of this condition.

With the adoption of the radical cure, abnormal semi-lunar cartilages have been assuming a position of more importance. As showing the relative frequency with which these two conditions are encountered, Allingham [42] found 12 cases of loose body and 35 cases of pathological condition of the semi-lunar cartilages in 59 cases operated upon for internal derangement. In 33 operations of this character performed by Robson,[41] 21 were for damaged semi-lunars and 12 for free bodies in the joint. In 106 cases of internal derangement which came to operation, Bennett [25] removed the semi-lunar cartilages 80 times and loose bodies 16 times. In 505 cases of recurrent effusion of the knee joint the same author found

obvious symptoms of loose body in 21 cases. That the differ-
ential diagnosis between these conditions is at times most diffi-
cult will be shown by the following case reported by Hub-
bard,[43] which had been examined by many men and was
frequently diagnosed as a slipping cartilage. The patient was
seen by Dr. R. F. Weir, of New York, who, after a careful
examination and a knowledge of the history of the case, was
of the opinion that the inner semi-lunar cartilage was the
seat of the trouble and advised operation. At operation the
cartilage was found to be thickened but this was not deemed
sufficient to account for the symptoms. Manipulation of
the limb allowed the escape of three unsuspected floating
cartilages. Allingham [42] cites a case in which his diagnosis
of damaged semi-lunar proved at operation to be a loose body.

He gives as characteristics of damaged semi-lunar carti-
lages: a, distinct history of traumatic origin; b, well defined
site of pain, either internal or external according to the carti-
lage damaged; c, no foreign body palpable; and d, no creaking
in the joint.

Cotterill [44] makes the point that in damaged semi-lunars
full extension is painful, while full flexion is painless. The
X-ray may be of value, in that loose bodies will practically
always contain bone, and therefore cause a shadow, while the
separated semi-lunar, being of cartilage exclusively, will not
show in the skiagram.

Under the title "Treatment of Puzzling Knee Affec-
tions" Hoffa [45] mentions the cases that were hitherto called
"Neuralgia of the Knee," and states that many such cases
are due to certain definite pathological changes within the
joint, among which he includes free bodies.

In reporting four cases of "Contusion and Laceration of
the Mucous and Alar Ligaments and Synovial Fringes of the
Knee Joint," Flint [46] mentions a very instructive instance
Case IV, in which at examination there was a sensation of
something slipping beneath the fingers in the swollen region.
At operation, the mucous ligament was found free in the joint
with a thickened jagged margin. On manipulating the joint
this reddened area comes to be between the outer margin of

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the patella and the condyle of the femur, and corresponds to the mass felt to slip beneath the finger before the operation.

Indications for Operation.—After the diagnosis is fully established there is no question but that the joint will continue to cause trouble until the offending body is removed. There is always a possibility that the free body may become attached in some cul-de-sac in an out-of-the-way location, and give rise to no further trouble, but such a fortunate contingency rarely occurs in actual practice. If the body is in such a location and giving rise to no disturbance it should not be disturbed. They should not be removed merely because they are present, but because they are causing symptoms and disturbing the function of the joint.

In case of doubtful diagnosis, rest, splints, massage, etc., should be judiciously tried before advising operation. Exploratory incision of the joint is allowable in certain cases. Allingham,[42] in 59 cases operated upon, found nothing abnormal in 3 instances. Bennett [25] made an exploratory incision 12 times in 106 operations and in 5 of these nothing was found to account for the symptoms, but in 2 of these 5 the exploration was followed by relief of the symptoms. Goldthwait [47] advocates incision and explorations not only for the various causes of internal derangement, but also in doubtful cases for diagnosis. The cases of Flint [46] were operated upon for exploratory purposes. Absolute diagnosis was not possible, but it was highly probable that some lesion would be found.

Treatment.—The treatment should be the removal of the offending body. The old classification into treatment by (a) direct incision, and (b) indirect incision, is no longer of practical value, and the second subdivision only of historic interest. Under perfect aseptic environs the operation is practically devoid of danger. The fact that there is danger in the opening of a large joint like the knee is established beyond cavil, but that the danger has been practically removed when operating under favorable circumstances is also well recognized. The joint must be approached with as much care and

solicitation as when we invade the peritoneal cavity. These two serous sacs, the peritoneal and the synovial, are similarly susceptible to infection, with the peritoneum being more tolerant. The power of the peritoneum to take care of a certain amount of infection is well known The serous lining of the joint cavities is not so resistant. The absence of a structure analogous to the omentum, " the policeman of the peritoneal cavity," may account in part for this difference. This well-known lack of resistance of the joint makes it necessary to exercise the utmost caution in the operation.

As showing how much disturbances may be caused by invading a large joint even though no sepsis is present, J. H. Barbat,[48] reports a case in which, 48 hours after the removal of a large body, there was great pain, pulse 120, temperature 101 F., with the knee swollen and tender. He removed a skin suture and allowed about two ounces of bloody serum to escape, which on culture media proved to be sterile. More serum was removed two days later, and on the twelfth day the condition was normal. General anesthesia is not always necessary, and the employment of infiltration anesthesia should be considered, if not used, in every case. In Case I the body was removed in a manner perfectly satisfactory to both patient and operator after infiltration with a solution of eucaine lactate gr. 1 to the ounce or normal salt solution, to which was added gtt. 4 of adrenalin chloride 1-1000. Houghton [49] removed a floating cartilage from an extremely neurotic individual after a similar analgesia and even tapped the articular surfaces with a knife without any objection being made by the patient.

The incision of the skin and that in the capsule of the joint should be on different planes, as a safeguard against the extension of a possible superficial infection from without inward. The incision should be located so as to expose the body to be removed and at the same time permit of an examination of the corresponding condyle of the femur. The incision generally employed is longitudinal at either side of the patella but this is not always sufficient to secure all of the bodies especially if they happen to be numerous, situated behind the condules, or attached. In some cases a more exten-

sive operation, with transverse division of the patella and complete exposure may be necessary, as in the case of Lords [50] in which he removed ten bodies. Sir William Banks [51] removed 40 after incising the tendon of the quadriceps and turning down a lower flap which contained the patella. These more serious operations are fortunately but rarely indicated.

The gloved finger may be used to palpate the articular cartilage. In this manner partially detached fragments have been discovered and removed, saving the patient from the necessity of a future operation. In dealing with the knee joint the " fingerless " operation has been insisted upon by many authorities, such as Koenig and Hoffa, but since the introduction and use of rubber gloves, which are essential, it would seem that the objections to digital palpation of the articular surfaces have been overcome.

These floating bodies of the joints are aptly called " gelenkmaus " by the Germans, because of their liability to disappear during the anesthesia or the operation unless such a contingency has been considered and measures taken to prevent it. The suggestion that a needle be passed through the skin and the body in the joint is not always practicable. Elastic constriction of the limb above and below the floating cartilage usually prevents it from slipping into the joint and out of sight at an inopportune moment.

The results following the removal of these bodies show a marked improvement, due without question, to the introduction and practice of aseptic surgery.

Paré [2] was the first (1558) to remove a loose cartilage from the knee joint, after which, removal by direct and indirect incision was performed with increasing frequency. In 1860 Larry [52] collected all of the cases up to that time, 170, of which 117 were successful, 33 died, and 20 were failures. Nine years later Benndorff [32] collected 169 cases, 109 with success, 46 deaths and 14 failures. Barwell [32] found 88 cases between 1860 and 1875, 73 successful, 5 deaths and 10 failures. The failures were ineffectual attempts to operate by the indirect or subcutaneous incision of the capsule, which method has been obsolete for many years.

Müller [2] in 1886 gathered 190 instances of operation for

the relief of this condition, with 96 per cent. recoveries and 4 per cent. deaths. Woodward [53] up to 1889 found 104 cases with six bad results, 2 amputations and 1 death. Marsh [54] mentions 72 instances of operative removal of these bodies between the years 1885 and 1895 with no deaths and 10 failures. During these same years Bolton [55] states that no fatal results has been recorded. Cloudot [56] found no death from an operation for this condition reported since 1877. Tenny [38] in 1904 found 297 cases since 1895, with no amputation and no deaths.

These late statistics are certainly interesting and encouraging when compared with the words of Benj. Bell [57] who, in 1787, while speaking of those bodies in the knee joint that are not freely movable said: " In this case I would advise *amputation of the limb*. The remedy is no doubt severe, but it is less painful as well as less hazardous, than the excision of any of these concretions that have been attached to the capsular ligament."

REPORT OF CASES.

CASE I.—D. S., male, forty years old, miner, Irish. Previous History: Fracture of right leg above the ankle about eight years ago, recovery perfect. During life he had received many more or less severe sprains, bruises and falls; and in his occupation he had frequently injured his knees, but had no recollection of severely injuring either joint. Present illness began about eight months ago, with an injury to his left knee. While timbering, in a crouched position, his right knee on the ground with the left limb abducted and semi-flexed, the foot on the ground and the knee about six inches above the ground, the force of his blows upon the timbers dislodged some particles of rock and a piece weighing about four or five pounds fell a distance of about ten or twelve feet, and struck his left knee, bringing it forcibly against the ground.

He experienced severe pain in the knee and the entire limb but in about an hour he was able to ride (horseback) to his home. After nursing the joint for a few days, he was able to walk about, but with a decided limp, due to the stiffness and soreness which remained for some weeks. About a week after the accident he consulted a physician who treated him for rheu-

matism; he became no better, and since the injury the knee had
been weak and unreliable, allowing him to work only a few
days at a time. The joint was always sore and painful, but
at irregular intervals there was a sharp shooting pain with a
locking of the joint, lasting a variable time from an instant to half
an hour. After these attacks of acute pain, the knee was swollen
and tender to touch and painful upon motion. Hot application
usually relieved the pain and reduced the swelling.

Six months ago, after one of these attacks of locking of the
joint, he noticed a swelling located upon the inner aspect of the
knee, at about the lower edge of the patella. Two months ago,
after a like attack, a similar swelling appeared about an inch
above the head of the fibula. These swellings were about the size
of an ordinary bean, hard, immovable, and very tender; they
remained visible for about three or four hours in each instance
and finally disappeared without the knowledge of the patient.
Hot cloths were applied each time, and caused relief from the
pain. On February 6, 1904, while splitting wood, he slipped,
twisted his knee, and had another attack of acute pain but
much severer than the preceding ones. He dragged himself from
the yard into the house, and on examining the knee, found a
swelling a trifle larger than the previous ones, in the same location
that it had assumed at the last attack, *i.e.,* above the head of
the fibula. (See Fig. I.)

The writer was called, and examined the joint about one
hour after the onset of the attack. The joint was not swollen,
mensuration showed both joints to be of the same dimensions,
there was no fluid in the joint, the limb was flexed at almost
a right angle, the motion was very limited and painful. The
entire left knee was very tender, though the pain at this time
was greatly lessened to what it had been, hot applications had been
continuously applied. The greatest tenderness was in the neigh-
borhood of the small swelling, pressure upon which caused
exquisite pain. This mass, a trifle larger than an ordinary bean,
was immovable, very hard, and the skin which was not reddened,
moved freely over it.

A diagnosis of floating cartilage was made, and its immediate
removal advised, but the patient would only consent to operation,
on the following day, if the symptoms did not disappear in the
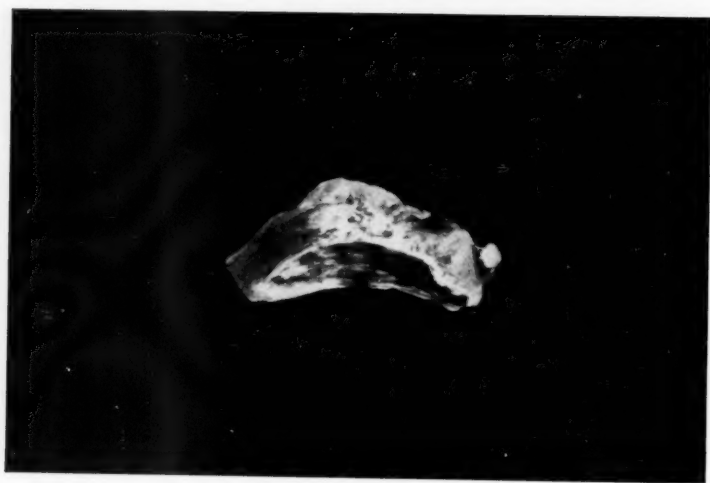
FIG. I.

FIG. 2.

FIG. 3.

mean time.   Consequently a hot moist dressing with a posterior
splint was applied.   On the following day, as the conditions were
practically the same, the patient was removed to St. Vincent's
Hospital. Operation February 7, 1904, assisted by Dr. J. A.
Jeannotte.   After the usual preparation and before the incision
an elastic band was applied around the knee, above and below the
body to be removed, to prevent it from slipping into the joint
during the maneuvers that might be necessary in its removal.
Anesthesia by infiltration, with eucaire lactate gr. 1, normal
salt solution oz. 1, adrenalin chloride, 1-1000 gtt. 4 was per-
fectly satisfactory.

An incision one inch long was made parallel to the long
axis of the limb over the tumor, which was situated an inch above
the head of the fibula,   Skin fascia, and capsule of the joint were
all divided and the mass of cartilage was grasped with a seques-
trum forceps and easily delivered.   It was then found to be
attached by a membranous pedicle, this was ligated, divided, and
the cartilage taken away.   The capsule was sutured with plain
catgut, and the skin with silkwormgut.   A collodion dressing
applied and the limb put up in plaster paris.

On the seventh day the plaster bandage was taken off
and the stitches removed, on the tenth day the patient was dis-
charged from the hospital, with the normal function of the
joint.   The body that was removed (see Figs. II and III) meas-
ured 1.5 cm. in length, .5 cm. in thickness, and .5 cm. in width.
Its external surface is convex, bony and rough, with many inden-
tations; the inferior surface concave, bony, and .5 cm. broad;
the superior surface is convex, bony and narrow terminating in a
distinct ridge.   The internal surface is flat and covered with a
layer of cartilage about 1 mm. in thickness.   At one extremity
of this body, the one to which the pedicle was attached,
there is found a distinct particle of bone about 1 by 3 mm. in
size, and this is held to the larger fragment by the cartilage in
which it is embedded.

Two months after his discharge, Mr. S. informed me that
he had been entirely well up to a few days previous, when he had
an attack very similar to those with which he suffered before the
operation, with the exception that the pain was not so severe. A
small swelling, about half the size of the body removed, presented

itself at the inner and lower aspect of the patella, the location in which he first noticed such a swelling about eight months previous. This swelling was noticeable for about half an hour, and the soreness of the joint was practically all gone the next day. He was told that there was certainly one, and perhaps more such bodies as had been removed still in the joint, and that the next time one presented itself he should come to the hospital at once and have it removed.

Four months later the patient again presented himself and reported that the knee was bothering him considerably. He said that he could feel a swelling down deep in the muscles of the upper portion of the calf of the leg. A few days before his visit, it had returned to its old location, at the inner and outer border of the patella, and had remained there all day, but the following morning it had disappeared and he felt much better. Examination of the knee at this time, was absolutely negative, the joint was apparently normal. The cicatrix of the operation was barely visible and caused no inconvenience.

CASE II.—J. G., male, forty-two years, switchman, American. On March 4, 1904, a locomotive ran over his right leg. He was immediately removed to St. Vincent's Hospital, where an examination revealed a crushing injury to the bones and soft parts of the right leg, which necessitated an amputation above the knee joint. Upon opening the knee joint a large floating cartilage popped out. This body (see Figs. IV and V) resembles a pumpkin seed in size and shape, it is 2.5 cm. long, 1.5 cm. wide and .5 cm. in thickness. One surface is hard, bony, and very rough and corrugate, with many large and small eminences and depressions. The opposite surface is slightly convex, its edges are raised and fluted, and the area within these raised edges is smooth and covered with a thin layer of cartilage. One pole of this body is broad, and the other comes to a point, and at this point there is attached, by a fibrous band, a very small spherical solid mass, in structure apparently similar to the bony part of the larger body. This small body is about 2 mm. in diameter and resembles a mustard seed. The joint was very carefully examined, but beyond a thickening of the synovial membrane there was nothing abnormal. The articular surfaces gave no clue as to the origin of the body.
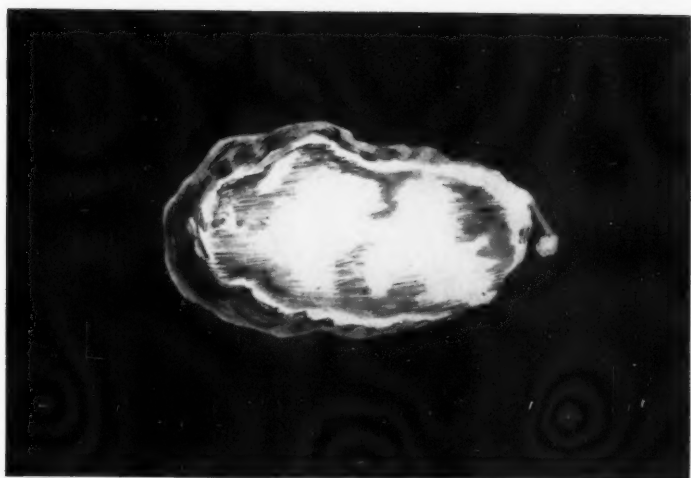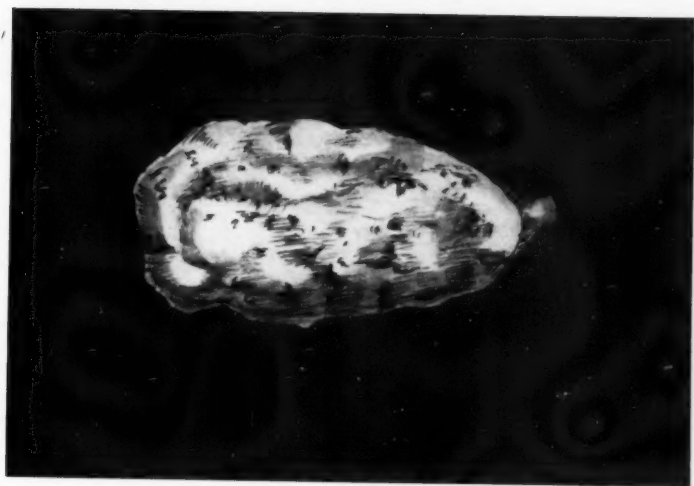
FIG. 4.

FIG. 5.

FIG. 6.

Upon inquiry, after the patient was convalescent, it was learned that he had, for many years, suffered with " rheumatism " of the right knee. He frequently had sudden attacks of sharp shooting pain in the joint, that would almost cause him to faint. With this intense pain, he could not move the joint nor even rest his foot upon the ground, but would have to lean against some stationary object until the pain had passed away. On more than one occasion he failed to catch a switching engine or car, because of this sudden pain which would make it impossible for him to move. In duration these attacks were always short. He never noticed any marked swelling of the joint, and after the attacks had passed away, he could go about his work as before, except that there would be some lameness, and that the joint might be sore and tender for some hours or days. He never had any trouble with the other knee, or any other joints. There was no history of any distinct traumatism.

A striking feature common to those two specimens is the smaller bony mass in connection with each. In review of the literature obtainable, reference to such small adherent particles is not found. Their significance is obscure; it would seem that they might be the origin of an additional body, and in the first case reported, where there was more than one body this explanation might seem tenable, but in the second case, it would seem that there had been ample time for a more advanced development of this second body. The presence of these smaller bodies in these two instances may be merely a coincidence, but if they are met with more frequently, they may be found to have a bearing upon the question of the formation of these floating bodies in the joints.

CASE III.—T. T., male, aged forty-one years, policeman, American. Previous History: Had most of the diseases of childhood, and " chills and fevers " when a youth in Missouri. When thirty-two years of age, had a severe attack of inflammatory rheumatism; all of the large joints were involved, the knee no more than others, with which he was confined to bed for six weeks. In his thirty-third and thirty-fifth years he had similar attacks of rheumatism, each of which lasted about six weeks.

Since then he has not been troubled with rheumatism or any other form of sickness. Present illness.—When fifteen years of age, he was riding horse-back, dismounted to open a gate, and in again mounting slipped and fell, but grasped a tug of the harness and was dragged along the ground head foremost for a distance of about twenty feet. He did not seem seriously injured, but there was a small triangular cut over the center of the right patella, as he remembers it this cut extended to the bone. The knee was somewhat swollen and slightly painful for a few days, during which time he remained in bed, and local applications were applied. In a week or ten days he had entirely recovered from the accident and was using the joint as usual.

About six months after this accident, he had his first attack of locking of the knee joint. While walking, feeling perfectly well, he experienced a severe sharp shooting pain in the right knee, which caused him to sink to the ground; he could not move the joint, but this pain and inability to move the joint soon passed away, and he was able to resume his walk. But there was considerable soreness remaining in the joint for a few days. Since then attacks similar to this one occurred at irregular intervals, four to six in a year, for a number of years. They never necessitated his being confined to bed.

About five years after the injury to his knee, there being no injury during the interval, he noticed the presence of loose movable bodies in the right knee. It seemed to him that there were many bodies in the joint, behind and on each side of the patella. They were about the size of a pea and some of them as large as a bean. He could feel them grate against one another or against the bones of the knee joint, and at times they would " pop " quite loudly, and would then cause moderate pain. Since first noting these movable bodies, he has always had trouble with the joint, has had " rheumatism," and the joint is a perfect barometer, always increasing in pain before the coming of a storm. The longest time that this knee has caused him to remain in bed has been about four or five days, only a few times. He admits, however, that he has many times hobbled around when it would have been much better for him had he rested. The use of strong liniment and the application of hot flannel cloths generally relieved the acute pain, and he was able to put up with the soreness.

About four years ago, the joint became ankylosed for about five days; this is the only time that such an occurrence has taken place. At present there is an almost constant pain when the joint is in action, but when at rest there is no pain. The limb remains a trifle flexed at the knee, and there is a slight eversion of the leg. The gait is very good, considering the pathology within the joint; it may be plainly seen, in walking, that one joint does not move as freely as the other. The patient states that the pain in the joint is much worse now, since these bodies became larger, than it was when the bodies were small, but he has not had the acute attacks of pain, with locking, for many years. The duties of a policeman are performed without any great apparent effort.

Examination: Well developed and nourished man, head, thorax, and abdomen negative. Both limbs of the same length, patella reflex normal on both sides. Left knee normal. Right knee ¾ of an inch larger than the left. Extension perfect, but extreme flexion is resisted and causes some pain. There is slight abduction of the leg. Passive and active motions of the knee are accompanied by crepitus. There is an effusion into the joint; the patella floats, but the normal depressions above and on each side of the patella are not obliterated. Palpation reveals a hard, resisting, movable mass about one half the size of the patella, situated below the tendon of the quadriceps extensor muscle. This mass can be moved laterally and also up and down, but only a small distance in either direction. It is not sensitive. A smaller body, about 1½ by ½ inches can also be felt; this body is freely movable and can be made to pass from the median line above the patella to the center of the right lateral aspect of the patella. This body is quite sensitive, and with its movements crepitus can be distinctly felt and heard. Sometimes this movable mass becomes lodged behind some muscular or tendinous structures and cannot be palpated, but some few maneuvers on the part of the patient can usually bring it within reach of the palpating fingers again. These are the only movable bodies that can be palpated but the patient states that occasionally a swelling can be felt in the popliteal space. The internal portion of the head of the tibia seems to be uniformly enlarged, and the tibial tubercle, the attachment of the patellar tendon, seems to be

enlarged and extended laterally and superiorly, on each side of the patella. (See Fig. VI.)

CASE IV.—G. V., male, thirty-six years, laborer, Italian. Previous History negative. Present illness: Entered D. & R. G. R. R. Hospital, because of a simple fracture of both bones of the right leg at about the middle. In addition to the above, at examination there was found a swollen, tender and painful right knee joint. With the rest and immobility necessary in the treatment of the fracture the knee rapidly improved. After union of the bones and removal of the cast, the patient complained of some pain, soreness, stiffness, tenderness, and creaking in the joint upon motion. Examination of the knee revealed the presence of some fluid in the joint, a slight abduction with marked lateral motion of the leg, complete extension caused no pain, but flexion to a right angle caused pain, with crepitus that could be distinctly heard and felt. It was impossible to locate the seat of this crepitus, there was no acute pain with it, but when the leg was flexed the patient complained of pain which he located in the center of the popliteal space. On the external surface of the knee between the condyle of the femur and the articular surface of the tibia, there could be felt a mass about $\frac{1}{2}$ inch wide and $\frac{1}{4}$ inch thick. This was movable; when pushed toward the center of the joint it seemed elastic and would spring back to its former position. The up and down and the anterior posterior motions were limited. The mass was not tender, nor was there any pain complained of when it was moved. Operation for removal of the body was advised but refused. Under rest and counterirritation, with pressure, the fluid was absorbed, the motion became much better, the abduction less marked, and the crepitus almost absent. But the mass could be palpated in the same position.

In the absence of operation and a presentation of the specimen, the propriety of including this case with the others may be questioned.

The mass in this case was certainly a movable body, outside of the joint, but its origin must have been within the joint; either from the articular surfaces or from the semi-lunar cartilages. After a careful study of the case I am constrained

to class this with the three cases of Bennett's in which a piece of the semi-lunar cartilage is torn from its connections anteriorly and then pushed forward, in this manner producing a tumor readily felt under the soft parts. Usually when the semi-lunars are damaged they are forced into the joint, or retain their normal position. In these cases a part of the cartilages is forced outward, as is very well shown in Fig. VII, taken from Bennett.[25]

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AN EXTERNAL METAL SUPPORT FOR DIRECT APPLICATION TO THE SHAFT OF A FRACTURED LONG BONE.

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DAVID J., a laborer, forty-five years of age, while working in a steel foundry on the 26th of December, 1901, was injured by a heavy steel beam falling across the left upper arm. A few hours later I saw him at St. Luke's Hospital in a condition of mild shock with a temperature of 98.6, a pulse of 80, and a respiration of 24. It was quite evident on first inspection that the arm had been about as badly damaged as was possible without it being completely severed from the body. On the anterior aspect was a large irregular wound through which one end of the humerus protruded, while the other extremity of it stuck out of a similar lesion on the posterior surface of the arm. The skin was torn for a distance of about two-thirds the circumference of the arm, the anterior wound reaching obliquely to the fold of the elbow, while the posterior extended longitudinally from the middle of the arm almost to the shoulder. More than half of the muscular substance seemed to be divided transversely and the bone, in addition to being the seat of a compound fracture as just mentioned, was also splintered for a short distance. The great vessels and nerves were not seen, though it is presumable that most of them escaped serious injury, since the pulse at the wrist and sensation over the lower arm and hand were practically uninterrupted. From the above somewhat inexact description, it will be seen, at least, that so much of the continuity of the member had been interrupted as to make the question of saving it a very grave and doubtful one. The patient was anæsthetized at once, the ends of the humerus squared off and united by a through and through wire, necessitating some two inches of shortening. All blood clots, shreds of tissue and dirt were removed, but no attempt at primary suture of the soft parts was made, owing to their crushed, devitalized condition. A

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rubber tube was drawn clear 'hrough the arm, the anterior and posterior defects stuffed out with gauze, and a very large aseptic dressing applied. No attempt was made at any form of permanent splint, since it was found that the soft parts over the two extremities of the humerus had been so extensively damaged as to make it a matter of impossibility to encircle one or both of them in such a manner as to insure support. Hence, as I say, I contented myself with merely wiring the bones to keep their ends from further damaging surrounding structures, and devoted my efforts to averting a general infection until some form of mechanical support for the bones could be devised and applied. The day after the operation the patient's condition was satisfactory in every particular, and on the second day his temperature arose to 101.6, the highest which was recorded during his convalescence. Four days after the injury he commenced to suffer great pain in the injured member, and this persisted until the ninth day, when the parts were placed at rest in the manner now to be described:

With the arm flexed at the elbow I applied a plaster bandage which included the chest, forearm and hand, the upper arm being left free, of necessity. A steel arch anchored at one end in the plaster enclosing the chest, and at its other in the bandage around the forearm, was suspended just above the upper arm. Beneath this arch was placed a vertical rod, which had attached to its lower extremity the silver splint shown in cut No. 1. This rode upon the ends of the bone like a saddle upon a horse, and prevented their natural tendency to rise up out of the wound, while an extension of the vertical rod fitted between the ends of bone, thus keeping the apparatus from gliding toward shoulder or elbow. However, under the influence of this direct splint the free bony ends showed a decided tendency to point downward and project through the gap on the posterior surface of the arm. Hence five days later a silver wire was passed under each extremity and carried out through the anterior wound, to be attached to the steel arch above After this was done the humerus remained absolutely rigid, there was no difficulty in dressing the large anterior wound by stuffing gauze in around the rod and the wires, the patient was occasioned absolutely no inconvenience by the apparatus, and except for tightening the wires as they

stretched the appliance caused us no concern during all the weeks that it remained in place. It is worthy of note that there was no more spontaneous pain after the application of the splint, although there had been a great deal before. Six weeks after the injury a new plaster bandage was applied, this time the arm

FIG. I.

straight at the elbow, but the silver splint and the wire swings were left in position. At the expiration of seven weeks the two silver wires which had held the bone up were removed, and I was delighted to find that there was now no longer any tendency for the splint to force the humerus downward, showing that there

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must be a reasonably firm union of some sort. It was, however, not until eight weeks had elapsed after the injury that I ventured to remove the anterior silver splint, when, to my great satisfaction, it was found that there was a decidedly firm union, although at this time it cannot have been a bony one, for the bone could be slightly bent at the point of fracture. Three days later the bone suture was removed for fear that it could not remain without symptoms, in what had been for so long a time an infected wound. Though all supports of every sort were out of the wound and the bone was reasonably firm and seemingly in good condition, the arm was now apparently a shapeless and useless mass of tissues, so long had it lain in splints. The hand and fingers were so œdematous that the patient could not bend any of the joints in them, and hence our efforts from this time were to reëstablish the physiological functions of the part. On March 7th, that is, ten weeks after the injury, the patient sat up for the first time, and two days later the last cast was removed from the arm. On March 17th,—that is, almost twelve weeks after he was hurt, it was necessary to anæsthetize him and break up the adhesions which had formed in all the joints. It was possible to do this without disturbing the newly formed union at the site of fracture and as a consequence a considerable degree of motion was possible in all of these joints which had previously been stiff. On the 10th of April, fifteen weeks after the injury, the patient was discharged from the hospital. There was still some œdema of the hand, though all the wounds were healed, and he possessed something like half motion in all of the joints. Six months later I saw the man, and was gratified to note that he could feed himself, take off his hat and put it on, and otherwise perform most of the functions which are expected of a healthy arm. The amount of strength now possessed by the member cannot be better shown than by adding that he can carry a hod full of coal or a bucket full of water without discomfort and without the slightest evidence of movement in the shaft of the injured bone. Dr. Clopton has made an examination with the fluoroscope, and tells me that he found the bone ends in perfect apposition, the axis of the shaft relatively straight, and presumes, from the fact that an extremely heavy shadow was cast by the callus, that the union at that time must have been bony in nature.

It is of interest in this connection to review briefly the various methods which have been adopted for the accomplishment of a firm union in compound fractures or those which have failed to unite primarily. These may be best divided into two groups, the first of which shall include the various appliances which can be completely incorporated within the extremity, and the second group made up of those which communicate with the exterior of the part. Under the first heading come the various forms of wires, nails, screws, plates, etc. Boeckel was the first to use ordinary screws in approximating the ends of oblique fractures, and is said to have accomplished some very desirable results in this manner. A double nail was used by Gussenbauer. This was an appliance shaped somewhat like a broad letter U, and each extremity of it penetrated a half of the fractured bone. Some sort of an ivory or absorbable bone rod was inserted into the marrow at the site of fracture by Bircher, and Von Bruns. Senn introduced a valuable aid in the treatment of oblique fractures of the thigh when he proposed his bone rings a few years ago at a meeting of the American Surgical Association. So enthusiastic over this proposition was Rickets that he termed Senn's bone rings the most rational means yet proposed of treating this form of injury. Ivory plates were tacked or screwed to the fractured bone by Sick, while similar plates of silver or other metal have been used, and in many instances with excellent results by Agnew, Redard, Steinbach, Martin, and White. In some respects the most nearly physiological, hence, the most nearly perfect of all the appliances which have been incorporated into the structure of a fractured part, is a bony flap. This has been successfully performed by Wolff, Mueller and Scheuer. This last-named author transplanted a rib into the shaft of the humerus, dividing the pedicle fourteen days later, and in this way accomplished a perfect result. This practically completes the list of the heteroplastic and autoplastic methods which have been advised for repairs of this kind.

Of the appliances which have held broken bones together, and at the same time communicated with the external world, but one has met with a marked degree of success up to the present time. I refer to Parkhill's clamp, which consists of

four parallel screw rods, two of them being driven through each portion of the bone and then held together outside the arm by wing-plates. The second appliance which I will mention as having a similar end in view is the one which I have presented herewith. The appliances to be incorporated will be passed with a mere mention since they have in reality no bearing upon the discussion at hand. In comparing these two methods, which contemplate an open wound and a communication with the exterior, I have no word of criticism for the Parkhill apparatus. The excellent results obtained by Parkhill, and with the same apparatus by Bennett, speak for themselves; but I will state that my appliance is decidedly the simpler of the two, can be quickly and cheaply made anywhere by anyone, and is certainly easier to apply than the other. It is surely not a very easy matter to drill four holes perfectly parallel, as must be done in applying the Parkhill apparatus. Again, the application of it takes some little time and must often be done during the shock which supervenes upon a serious injury, and last, but not least, the relation of the parts must be considerably disturbed in order to carry out the process.

As I have stated, it is a very simple matter to place my apparatus in position. All that is necessary is to square off the ends of the bones a very little, hang a wire under each, and place the little saddle upon them. Furthermore, it is extremely easy to remove the entire apparatus when its purpose has been accomplished. In the case at hand this was done without the use of any anesthetic, general or local, and the patient complained of no pain whatever. There was no necrosis as a result of pressure, and I must express myself as pleased in every way with the result accomplished. I claim further for this simple procedure a far wider field of usefulness than is possible where any of these other devices are used. The proposer of each of these others has been careful to state that a well-fitting plaster cast or other splint must be applied to the portion of the extremity injured in order that his apparatus may best subserve its function. Now, it will be remembered that in my case the soft parts were injured from the shoulder to the elbow, making it manifestly impossible to apply any sort of splints which might remain in position anywhere between

the two points mentioned.   My only possible points of anchorage were the chest and the forearm; hence, it will be seen that the device here employed meets the requirements of cases in which all methods must fail which depend in any sense upon a permanent cast applied between the shoulder and the elbow.   There is no reason why it cannot be used in a fracture of the thigh, or in one of any other long bone for that matter, and I especially recommend it in just those most extensively lacerated cases where an extremity might be lost or permanently deformed if any dependence had to be placed upon an external splint for the part.

THE USE OF WOLFE GRAFTS AND TENDON-LENGTHENING IN TREATING CICA-TRICIAL CONTRACTURES.[1]

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WHEN the skin about joints is destroyed by burning or otherwise, the healing process is accompanied by contraction, and firm cicatricial bands are often formed which hold the members in distorted positions. The thumb may be drawn backward upon the forearm, the fingers on the palm or even on the dorsum of the hand; the forearm may be so flexed upon the arm as to be of little use; the foot may be inverted or everted so that the patient cannot walk on the plantar surface, and various other deformities may result. These cicatricial contractures are among the most annoying conditions which the surgeon has to deal with, since the force which caused the original contracture is apt to cause a new one when the first one is corrected. Many methods of treatment have been employed. A common one is to divide or dissect out the cicatricial band and hold the member in a splint during healing. If, after the dissection of the cicatrix, the edges of the skin can be brought accurately together without undue tension, the method gives a great gain; but in many instances they cannot be so brought together and the resulting contraction is almost, if not quite, as bad as that for which the operation was done. Thiersch grafts have been often used to cover the defects, but contraction still goes on. Wolfe grafts, which include the entire thickness of the skin, are also used, and the result is much better.

The six cases here cited have been treated by excision of the cicatricial tissue, the lengthening of tendons in some instances, and the use of Wolfe grafts to fill in the defect.
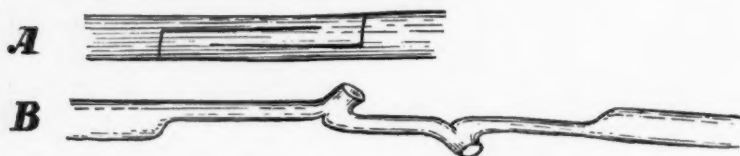

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It may not be amiss to call attention anew to the value of grafts composed of the entire thickness of the skin. Wolfe[1] of Glasgow, in 1875, used such grafts in the treatment of ectropion. Krause[2] of Altona, in 1893, presented before the German Surgical Society the results of operation in 21 cases in whom he had used grafts taken after Wolfe's method, but much larger than Wolfe had advocated and used in a much wider range of conditions. Some of his grafts were eight inches long and two and a half wide, and he used them for filling up large defects after extensive ulcers and bone necroses, after machinery accidents, face lupus, extirpation of tumors, etc. The method is very generally known by his name. In the twenty-one cases he made over one hundred grafts, and only four failed absolutely, although there were others in which there was partial failure, and he speaks of small necrotic spots as being quite common in the grafts. In his report of 1895 he emphasized the statement that these grafts were only to be employed when Thiersch grafts were not suitable. Many observers have reported on the method, among whom we may mention Henle[3] and Wagner from Von Miculicz's Klinik in Breslau, and Widman[4] from Nürnberg. The former reported fifty-one cases, among whom there were thirteen failures, eight partial failures, and thirty complete healings. The latter reported twenty-nine operations, with three absolute and two partial failures. The percentage of failures is so much greater than with the Thiersch method that it has not been popular; and Fowler probably expressed the general opinion of surgeons of the time when he stated in *Dennis' System of Surgery*, that these flaps are rarely used on account of the frequent failure of nutrition and consequent death of the flap. In the literature of the last few years one seldom sees reference to the method, although it is used by many surgeons in the few cases for whom they think it advisable. Among Krause's, Mikulicz's and Widman's cases the use of these grafts in cicatricial contractures of the finger and hand is referred to and Kennedy[5] in 1899, reports two cases in whom he used them with marked success, and a third in whom failure was due to the changing of the dressings at home by a relative of the patient. In one of his cases he used a Thiersch graft on one finger and Wolfe

grafts on the other two. The Thiersch graft was followed by a severe recontracture, while the Wolfe grafts were followed by excellent results.

No report of tendon lengthening in these contractures has come to the writer's notice, although it must have been done many times. The method here used was that proposed by Hibbs [6] for lengthening the tendo Achillis.

It is more rapid than making long diagonal division and sewing the ends together, and no stitches are left in the tendon. Whether fewer adhesions result is debatable.

HIBBS' METHOD OF TENDON-LENGTHENING.

CASE HISTORIES.

CASE I.—M. N., History No. 2, series 3, aged thirteen years, was admitted to St. Mary's Hospital, November 13, 1900. In early childhood she had received an injury from a pistol-hammer; this resulted in a contracture of the terminal phalanx of the right ring finger, which was drawn forward and outward and was firmly held at right angles with the rest of the finger; extension was impossible.

November 22, under ether, the contractile band was excised. The cicatricial tissue extended down to the capsule of the joint. The deep flexor tendon was so much contracted that it had to be lengthened, in order to extend the end of the distorted phalanx. The joint seemed normal. A Wolfe graft was cut from the thigh and sewed into the denuded area with fine silk stitches. Rubber tissue was applied and a firm protective dressing. This was left in place for two weeks; the outer dressing was then removed, leaving the rubber tissue in position. The dressing was changed at intervals of about a week until six weeks from the time of operation. The epidermis loosened from the flap and came away, but the true skin adhered to its position and was very firm. The motion in the joint remained good (see photograph). The

PLATE I.   (CASE I.)

FIG. 1.—Cicatricial Contracture of Right Ring Finger; of ten years duration.

FIG. 2.—Photograph of Hand two years after operation.   Posterior view.

FIG. 3.—Photograph of Hand two years after operation; Lateral View; Fingers extended.

FIG. 4.—Photograph of Hand two years after operation.   Fingers flexed.

PLATE II. (CASE II.)

FIG. 1.—Contracture of Thumb and Hand, following Burn.

FIGS. 2 and 3.—Radial and Ulnar views of Hand, one and a-half years after the beginning of Treatment.

patient was seen two and three-quarter years after the operation; there was no return of the contracture and no loss of motion. She has since died of phthisis.

CASE II.—N. P. (History No. 1382), aged four and one-half years, admitted to St. Mary's Hospital, April 21, 1904. One year ago clothing caught fire and extensive burns of face, hand, forearm and abdomen resulted. The consequent deformity in the hand was excessive (see photograph); the thumb was drawn almost over to the flexor side of wrist and held by firm cicatricial tissue; in a similar way the little finger was drawn onto the palm, and the ring finger half way there.

April 29, 1904. The scar tissue was dissected away from the base of the thumb, the extensor tendons of the thumb, which were much contracted, were lengthened. The hand and thumb could then be extended nearly to their normal positions. After the edges of the skin were stitched there were two irregular defects in the skin, one 2½ by 1 inch and the other about 1 by ¾ inch. These were filled in with Wolfe grafts, which were stitched into position with fine silk and dressed in the ordinary way.

May 11. First change of dressing. Grafts look well; bluish in color. Only slight discharge in the gauze.

May 20. Thumb in good position. Grafts have held firmly.

May 26. Sent from hospital on account of whooping-cough.

September 16. The thumb was found to be in good position and has several degrees of voluntary motion; the hand was still slightly flexed on the forearm. A cicatricial band was therefore divided and a graft, 2 by 1 inch, inserted on the flexor side of the forearm. The scar tissue was also dissected off from the proximal interphalangeal joint of the ring finger and a graft, 1¼ by 1 inch, inserted there.

October 10. These were entirely healed.

October 18. Little finger amputated, consent having been withheld before. After the healing of this wound she was treated by massage and her hand continually improved, but on January 5th, as there was considerable ulnar deflection of the hand, the cicatrix of that side of the wrist was incised, a part of it dissected away and a graft, 1½ by ¾ inch, was inserted. This held well, and massage was again used; but on June 28th, as

there was still some ulnar deflection, another incision and dissection were made and a diamond-shaped graft, 2 by 1 inch, was inserted. This was well healed in place in five weeks and the patient sent home. The accompanying photographs were taken two and a half months later and show the deformity well corrected.

CASE III.—E. C., History No. 1664, aged 12 years, July 26, 1904. Hand was burned when he was a small child and a contraction has followed. The terminal phalanx of the left index finger is drawn forward, almost to a right angle, and held by dense scar tissue. The middle and terminal phalanges of the little finger are flexed upon the proximal phalanx which in turn is held backward toward the dorsum of the hand by firm cicatricial bands. (See photograph.)

Operation July 29th. Cicatricial tissue excised from flexor side of both fingers, deep tendon of index finger and superficial tendon of little finger lengthened. Grafts sewed in with catgut. Dressed in usual way.

First dressing changed August 6. Wound clean. Grafts look grayish-white.

August 20. Dressing changed: grafts have taken, excepting small area at the end of the one on the little finger.

September 3. A slight granulating spot at margin of little finger graft.

October 8. Discharged cured.

November 8, 1905. Presented before New York Surgical Society. Hand useful and shows hardly any practical disability. Extension of both fingers almost normal. Flexion in both little and index fingers about ⅔ the normal. No voluntary motion in terminal joint of index finger. (See photographs.)

CASE IV.—M. C. (History No. 1965), aged four and one-quarter years. April 4, 1905. Three years ago (when sixteen months old) fell and cut palm of hand and base of index finger on glass. A contracture followed, which increased for a few months and has since been stationary (see photograph). The right index finger was found flexed at the proximal interphalangeal joint, and held by a firm cicatricial band which extended well into the palm. There were several degrees of motion at the metacarpo-phalangeal joint.

PLATE III. (CASE III.)

FIGS. 1 and 2.—Cicatricial Contractures of Index and Little Fingers of about ten years duration.
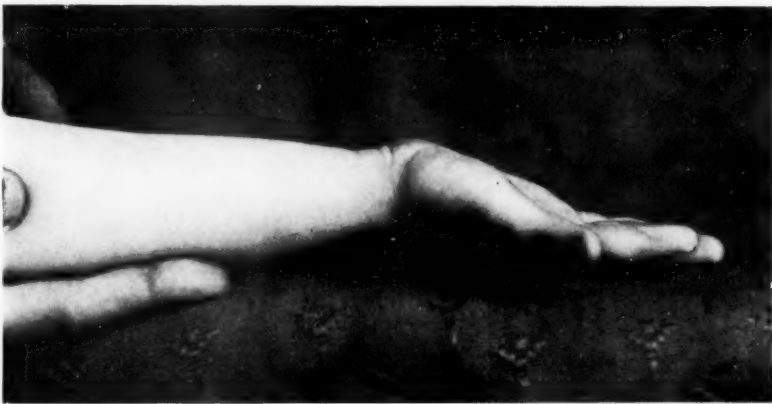

FIGS. 3, 4, and 5.— Photographs of Hand in Extension and Flexion one year after operation.

PLATE IV. (CASE IV.)

FIG. 1.—Contracture of Index Finger of three years duration.

FIGS. 2 and 3.—Hand in Extension. Flexion, six months after operation.

April 6, 1905. Cicatricial tissue dissected out. Just under the skin it was very firm and band-like. An elliptical graft, 1¼ by ¾ inch in size, was stitched into the defect. Nine days later dressing changed for first time; condition of graft good. Seven days again dressed; doing well. One month after operation graft of good color and firm. Three weeks later discharged with graft firm and several degrees of motion in finger.

Seen October 21, 1905. Finger held extended; no contracture (see photograph). She can flex it to a right angle, and when she does so the tendon can be felt in the palm and at the base of the finger. It is, however, adherent in the proximal phalanx of the finger, and gives no independent motion in the distal and middle phalanges.

CASE V.—S. C. (History No. 1838), aged seventeen years, congenital deformity of hands. (See photograph.)

February 16, 1905. Left little finger. The very dense band of fibrous tissue, which resembled that of the other cases, was dissected away and the finger straightened. A skin graft, 2½ by 1¼ inches, was stitched into the defect and the usual dressing applied, with the finger in extension.

February 27. First dressing; doing well.

March 1. Second dressing; doing well.

March 3. Third dressing. Patient discharged from hospital, to be dressed by Dr. George W. Kosmak, who sent her there.

May 18. This finger was found to be nearly straight, with slight flexion at the terminal joint; held in slight adduction, ten to fifteen degrees of motion in each joint.

Operation May 18 on right little finger. Operation similar to that on left side. Two grafts were used; one kite-shaped, 2 by 1 inch, and one of irregular shape, ½ by ¼ inch. First dressing, eleven days later; graft dry and clean, position of finger good. Patient referred to Dr. Kosmak for further dressing. Healing took place well. No other operation was deemed advisable, excepting the removal of the terminal phalanx of one of the fingers. The contractures were relieved and the healing of the grafts was satisfactory, but on account of the congenital defects, the resulting fingers were far from normal.

CASE VI.—J. N. (History No. 2100), aged seven years.

March 20, 1905. One year ago clothing caught fire and she was severely burned about the chest and left arm. The areas about the upper arm and chest were covered partly by a flap taken from the side of chest, and partly by Thiersch grafts, but the elbow was held flexed at a right angle by contractures which had formed in the early process of healing.   (See photograph.)

June 26, 1905. A transverse cut was made at the flexor surface of the elbow and the skin was loosened about its edge. The arm was then extended. The resulting defect, 2 by 2½ inches, was filled by a skin graft and dressed in the usual way.   It was dressed eight days later, the graft showing the ordinary pale bluish color for that period of healing. One week later color good. A slight necrotic spot developed in the centre of the graft and a small spot of granulation at its edge. These were slow in healing as it was difficult to prevent the irritation of the forming scabs, even through the dressing.

She was however discharged from the hospital five weeks later in good condition and with good power of extension in the arm.

Seen four months after the operation: slight keloid about the edge of the graft and in a spot in its centre, but the skin is of good quality and firm and motion in elbow is normal.

In review we note that in the five traumatic cases the contractures were relieved and showed no tendency to recur after periods of, respectively, thirty-three, eighteen, fifteen, seven and four months from the times of the first operations.   In the congenital case only the little fingers were susceptible of treatment, and these were greatly benefited. The left one, which was contracted backward so as to be not only useless, but an obstacle to the use of the hand, was changed to nearly a normal position, has several degrees of motion in each joint and is a useful member. The right one has been released from its constriction and might well have good motion, but for the congenital malposition of the parts. The grafts were all movable over the underlying tissues. Sensation was present in them; in some instances minute hairs were growing in them, and the skin was almost normal. There was a tendency to thick-

PLATE V. (CASE V.)

FIGS. 1 and 2.—Congenital Deformity of Hand.

FIGS. 3 and 4.—Little Finger in Extension and Flexion. Eight months after operation.

PLATE VI. (CASE VI.)

FIG. 1.—Cicatricial Contracture of Elbow. Extension limited to about 90°.

FIG. 2.—Arm four months after operation; motion in Elbow normal.

ened scar formation about their margins in varying degrees, and in one case this extended into the substance of the graft, but in no instance was this enough to interfere with the free use of the adjacent joint.

The value of tendon lengthening also is of interest. It was done six times in this series: One deep flexor of ring finger at terminal joint. One extensor ossis metacarpi pollicis. One extensor prima internodii pollicis. One extensor secundi internodii pollicis. One deep flexor of index finger. One superficial flexor of little finger.

In the first case the resulting motion was practically normal. In the extensors of the thumb the resulting motion was about half the normal, limitation in extension being apparently due to a cicatricial band in the middle of the wrist and palm, which had not been sufficiently divided. The result for the superficial flexor of the little finger was apparently good, but it was difficult to distinguish the action of the deep and superficial tendons. In the last instance the lack of voluntary motion in the terminal joint indicated that the lengthened tendon was so adherent as to give no independent motion.

These results are surely sufficiently good to warrant the further trial of these two elements in relieving these contractures. They are surely much better than the author has seen from other methods.

In estimating the value of the procedure, we must manifestly consider the difficulty in securing union in the grafts. This difficulty has been sufficient to make the " entire skin " method of grafting unpopular. With the small grafts which are usually needed for contractures, however, and the clean surface which can be obtained, there is little difficulty in obtaining union. In this series every graft held well. If we include in the series a failure of a graft in a contracted ankle, where an ulcer was present and the tissues were very poorly nourished we still have ninety-three per cent. of successes. Operation for these cicatricial contractures can almost always be done in well nourished tissues, and without the presence of ulceration, and we may confidently expect the graft to hold in almost every instance.

Technique.—There are some points about the technique which are important. Aseptic operation without the use of germicidal solutions is desirable; also hæmostasis, when possible by pressure, without the use of ligatures. The grafts may be held in position by small silk stitches, although Krause considers this unnecessary.

The method of dressing has varied greatly with different operators. Kennedy in one instance left the first dressing of sterilized gauze in place five weeks, healing being complete on its removal. Wolfe, whose operations were on the face, usually changed the first dressing on the third day and then made daily dressings. Krause changes his first dressing in three or four days and dressed the wounds again every two or three days, soaking off the gauze with boracic acid solution immersing the entire member in the solution for about an hour. Of course the method must differ somewhat with the case. Cleanliness and fixation are the two desired conditions. If there is doubt about the former, the dressing would be changed oftener than if asepsis is assured. The nourishment of the graft takes place by effusion at first, and then minute vessels have been observed running into the graft itself, in some instances communicating with those vessels which already existed there. It is important that the grafts should not be moved, as these vessels are of course very delicate indeed. It is difficult to avoid moving the grafts in changing the dressing, and therefore great care must be used. In the cases here reported rubber tissue has been put over the graft and allowed to extend about a quarter of an inch beyond its margin on all sides. Moist gauze has been placed above this, which is also protected by rubber tissue to prevent its too rapid drying, and this has been enveloped in dry sterile gauze. The part has usually been put in plaster, and the first dressing has been done eight to fourteen days later. If there is a purulent discharge, it can quickly be told by the odor, a part of the gauze being left uncovered by the plaster for this purpose. The first rubber tissue is usually not changed at the first dressing; if changed it has been replaced by a similar one. One can easily appreciate the advantage of Krause's method, which consists in soaking

the entire member for an hour in boracic acid solution until the gauze is entirely loosened from the graft; but many of these contractures occur in children, and it would be practically impossible to follow this method with them without having the graft injured.

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FRACTURES OF THE METACARPAL BONES.

BY RAYMOND RUSS, M,D.,

OF SAN FRANCISCO, CALIFORNIA.

METACARPAL fractures are far more common than the older writers would lead us to believe. For instance, Malgaigne found but sixteen cases in a total of 2377 fractures, or .67 per cent. Hamilton bases his observations on but ten cases. The X-ray has added much to our existing knowledge of these fractures, and it is safe to assume that many cases which have previously been diagnosed as contusions and dislocations have belonged to this class.

But little attention has been given to these injuries, and the scanty literature upon the subject and the brief accounts to be found in our surgical treatises have led me to collect the cases which have come under my observation. The majority of metacarpal fractures present few difficulties. The fractured bone is well splinted by its fellows. Deformity is often slight and reduction fairly easy. A certain number of old cases have been observed in patients presenting themselves for other lesions, and the marked shortening which has followed, resulting in the loss of the knuckle, and the excessive callus which has formed have shown that existing methods of treatment are imperfect.

My own series embraces twenty-seven cases, the greater part of which have presented themselves at the Surgical Clinic of the University of California Dispensary. The fractures have occurred in patients ranging in age from fourteen to sixty-three. I have seen but one case of metacarpal fracture occurring in a woman. Friedrich reports having seen but one female patient in the entire material of his polyclinic. Of my cases, but one has occurred between the ages of ten and twenty years, eight between twenty and thirty years, ten between thirty and forty years, five between forty and fifty

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years, two between fifty and sixty years, and one over sixty
years.   In but one case of the series was more than one meta-
carpal bone fractured.   This was a fracture of both the fourth
and fifth metacarpals of the right hand resulting from a fall.

The cases which have come under my observation have
been particularly free from complications.   None of the fract-
ures were open.   Fractures of the phalanges complicating
fractures of the metacarpals have not been frequently met
with.   I have seen but two such cases, the first, a fracture of
the first phalanx of the little finger complicating an oblique
fracture of the middle of the shaft of that metacarpal and re-
sulting from a fall from a height; the second, a fracture of
the first phalanx of the fourth finger complicating a fracture
of the fourth metacarpal.   This patient had been held up by
footpads, and, in endeavoring to defend himself, had received
several blows with some heavy weapon across his clinched
fist.

In my series I find that the first metacarpal has been
fractured in 29 per cent., the second in 15 per cent., the
third in 11 per cent., the fourth in 15 per cent., the fifth
in 26 per cent., and the fourth and fifth together in 4 per
cent.   Fractures of the first and fifth bones then have been most
frequently met with.   This is contrary to the statement of
Stimson, who says that the third and fourth are most fre-
quently broken, the first and fifth least.

Nine of my fractures resulted from indirect violence, a
blow delivered with the clinched fist, the force being received
on the distal end of the bone and operating in the direction of
its long axis.   Hamilton states that five out of his ten fract-
ures were produced in this way.   A force thus applied will
generally make an oblique fracture about the middle of the
shaft.   In one of my nine cases the first metacarpal was in-
volved, the second was fractured in two, the third in two, the
fourth in one, and the fifth in three.   The fifth metacarpal is
probably fractured in glancing blows upward.   Another case

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of indirect violence said that he had tripped and fallen, re-
ceiving the impact of the fall upon the tip of the thumb, held
at the time in extension.   This produced a fracture at the
middle of the shaft.   Lonsdale has recorded a case in which
fracture of the third metacarpal was caused by a fall upon
the end of the outstretched middle finger.   The cases of direct
violence have resulted from falls upon the back of the out-
stretched hand caused by slipping on the pavement, or falls
from a height, as a wagon or street car.   In two cases the
injury was caused by blows delivered across the back of the
hand, one being a fracture of the first, the other a fracture
of the fourth metacarpal.

The first metacarpal bone may be broken at any place in
its length.   I have found the diagnosis of these fractures ex-
tremely difficult in some cases on account of the extensive effu-
sion occurring into the flexor tendon sheath.   Two of my cases
are especially interesting, as they are good examples of the so-
called Bennett's fracture or stave of the thumb (*British Med-
ical Journal*, July, 1886).   This is an oblique fracture at the
base of the first metacarpal bone.   Bennett obtained six mu-
seum specimens which showed this deformity.   From these he
was led to conclude that the fracture was a very common one,
and he believed was often mistaken for partial luxation of the
metacarpal bone of the thumb.   The eighteen years, however,
which have followed the publication of Bennett's article have
proved his conclusions to be erroneous.   The fracture is rare.
I have found since Bennett's article but two cases reported in
the literature, one by Roberts, of Philadelphia, reporting a case
of Dr. G. T. Beatson, of Glasgow, Scotland (*Philadelphia
Medical Journal*, March, 1901), the other by Prichard, referred
to in von Bergmann's " Surgery."

The history of my first case is as follows:
J. B., a railroad engineer, aged forty-one years, while adjust-
ing the headlight on his engine, slipped and fell.   He remained
unconscious twenty-five minutes.   He resumed work soon after

the accident, but his left hand was very painful. Eight hours later, when he reached the city, his glove had to be cut off. The whole hand was much swollen. Careful palpation of the meta-carpal and phalangeal bones revealed no fracture. The hand was treated as a simple contusion and hot applications made. One month later the patient again reported. The thumb was still very painful, especially when adduction was attempted. The patient had not been able to resume work since the receipt of the injury. The maximum tenderness was at the base of the first metacarpal bone. There was considerable fluid in the flexor tendon sheath. Outside of the thenar eminence there was little swelling. The bone was fractured in two places, obliquely just below the articu-lation and longitudinally running into the joint between the meta-carpal bone and the trapezium. The thumb was put up in abduc-tion, being held in this position by an internal rectangular card-board splint. One month later the joint was somewhat stiff, but the patient had been able to resume work.

The following is the history of the second case of Ben-nett's fracture which I have seen:

T. D., aged twenty-seven years, an oiler by occupation, took part in a street fight two days before he presented himself to me. He reported that he struck a heavy blow with his left fist tightly clinched, the force being received on the head of the first meta-carpal. He went immediately to the City Receiving Hospital, where a diagnosis of backward dislocation of the first metacarpal was made and a pasteboard splint applied. On examination, I found great swelling over the thenar eminence. Posteriorly, there was a prominence at the base of the first metacarpal. The thumb appeared slightly shortened. Profiting by my first case, I suc-ceeded in eliciting crepitus at the metacarpal base. The radio-graph (Fig. 1) was then taken. It shows a displacement of the distal fragment upward. A slate-pencil coaptation traction splint, to be presently described, was then applied, and this reinforced by a rectangular card-board splint. Function was restored at the end of three weeks.

The displacement in this case was similar to that present in the one reported by Roberts. There was no displacement noted in my first case. The injury is probably caused by a blow upon the tip of the thumb, held at the time in extension, or upon the head of the metacarpal, the fist being clinched. The case cited by Bennett is instructive. A young man, while horseback riding, was thrown violently forward, the tip of the thumb being dashed against the pommel of the saddle.

Through the kindness of Dr. Harry M. Sherman, I have seen a case of spiral fracture of the fourth metacarpal occurring in a woman. This woman was an asylum nurse. The fracture resulted from the corresponding finger being twisted by an insane patient.

Fractures through the metacarpal heads are uncommon. The following case is of interest on account of its rarity and the facility with which reduction was maintained.

P. C., aged twenty-seven years, a longshoreman by occupation, while alighting from a street-car was thrown, violently striking upon the back of his right hand. When he presented himself at the clinic the next day, there was considerable swelling over the second metacarpal-phalangeal joint, the knuckle being greatly depressed. The first phalanx was found to be intact, but its base had sunk on to the dorsum of the hand, resembling a dislocation. On palpation, crepitus was determined at the head of the second metacarpal. There was considerable displacement of the fragment. Fractures at this point are held with the greatest difficulty, and, as the fracture ran into the joint, the patient was told that, notwithstanding what might be done, he would probably have a stiff finger. Reduction was accomplished by means of forcible traction, and the following dressing was then applied. Slate-pencils were placed as coaptation splints on each side of the broken metacarpal, two in the palm and two on the back of the hand. These extended from the metacarpal base to the middle of the shaft of the first phalanx. The slate-pencils were firmly secured in position by means of two narrow strips of adhesive plaster passed about the hand.

Small rubber bands were then placed over the projecting ends of each pair of slate-pencils so that they would press quite deeply into the interosseous spaces. The dressing was then completed by making traction forcibly upon the finger, and maintaining this traction by means of an adhesive strip wrapped firmly about the finger and the projecting ends of the four slate-pencils. Cotton was then placed between the fingers and about the tips of the slate-pencils to prevent rubbing, and the dressing completed by a posterior splint of wood. (Fig. 2.)

On inspecting the hand three days later, I found that the dressing had held remarkably well, nor did the patient complain of it. Although it had been necessary to apply it quite tightly, there had been no interference with the circulation. The dressing was then removed. Seven days after the dressing was applied, the hand was again examined. I was surprised to find that the patient had complete range of motion of the index-finger, and that the affected knuckle was as prominent as the corresponding one on the uninjured side.

This splint has been used with excellent results for all fractures about the heads or distal portions of the shafts of the metacarpal bones. By its use accurate approximation has been obtained, and the callous, deformities and shortening, so common in these fractures, avoided. Traction, difficult to obtain on account of the laxity of the metacarpo-phalangeal joint, has been more satisfactory in this method than in the older modes of treatment which have been previously employed. Small lead-pencils may be used with equal facility. Some slate-pencils are too brittle to be of service. The dressing is applied with considerable difficulty to the second metacarpal, but is easily applied to the third and fourth. For the first and fifth metacarpals the dressing is modified by employing two pencils placed in the interosseous space and one pencil applied laterally. Dressings of the thumb should be reinforced by the internal rectangular splint. In all these dressings a posterior splint of wood or card-board is an additional safeguard.

The dressing recommended by Carl Beck (*New York Medical Journal*, August, 1900) has also been used with good results in cases where traction was not necessary. This consists of a co-

aptation splint made of short pieces of drainage-tube of moderate size applied on each side of the fractured bone on the dorsum of the hand and held in place by strips of adhesive plaster. The old dressing—a roller bandage placed in the palm of the hand, the fingers being drawn down firmly over it—has been employed in a number of cases in this series, but has not given uniformly good results. Traction in this method is very unsatisfactory. The pressure exerted is unequal, and posterior bowing of the fractured metacarpal has occurred. Fractures of the second and fifth metacarpals are very inadequately protected by this method, and no attempt is made to correct lateral deformity.

I have operated for malunion and painful callus in one case in this series. This was a man aged thirty years, a cabinet-maker and a musician. He had fractured his fifth metacarpal, right hand, while striking a punching-machine. He was attended by a physician at the time, but the lesion was unrecognized. When he applied to me one month later, there was a large amount of exuberant callus over the lesion; there was considerable shortening, and movements of the finger were very painful. He had been unable to follow his trade or pursue his musical studies since the accident. Under anæsthesia, an incision was made on the dorsal surface over the fifth metacarpal, the exuberant callus chiselled away, and the bone refractured. The operative wound was then closed and the finger placed on a wooden extension splint, the coaptation dressing of Beck being also employed. The patient had free use of his finger three weeks after the operation. The end result is shown in the radiograph (Fig. 3). There is slight lateral deformity and some thickening over the bone, but the knuckle is prominent. The range of motion is perfect.

The diagnosis of metacarpal fractures presents few difficulties. All the bones are easily palpable, and in fresh cases crepitus can generally be ascertained. For obtaining crepitus, the method recommended by Scudder is useful. "Grasp the finger corresponding to the fractured metacarpal with the whole right hand, steadying the injured metacarpal with the left hand, and make steady and continuous traction." This method serves admirably also for reduction. The fracture heals very rapidly, and for this reason early motion is advisable.

FIG. 1.—Bennett's fracture or stave of the thumb. (Case II.)

FIG. 2.—Dorsal view of coaptation and traction splint of slate-pencils applied to a fracture of the third metacarpal.

FIG. 3.—End result in operation on fifth metacarpal for malunion and painful callus.

Bennett's Fracture. Case IV.

FRACTURE OF THE ASTRAGALUS WITH SUB-ASTRAGALOID FORWARD DISLOCATION OF THE FOOT. REMOVAL OF THE ENTIRE ASTRAGALUS.

BY C. O. THIENHAUS, M.D.,

OF MILWAUKEE, WIS.

Mr. F., a Finlander, thirty-seven years old, from Ishpeming, Mich., a miner by occupation, seen in consultation with Dr. B., in Ishpeming, gave the following history:

Four months ago, while working in a mine, he fell backwards from a height, a number of rocks falling with him. He landed on his feet and after being extricated from the rocks it was found that his left ankle was swollen considerably and the foot dislocated forwards. An immediate attempt was made to reduce the dislocation under narcosis, but it proved unsuccessful, and as an insurance company paid for him while unable to work, he would not permit a bloody reduction immediately.

When I saw him four months later the following status presented itself: The ankle joint of his left leg was partially ankylosed. The left foot, on which he was unable to step, was standing in a decided varus position and seemed largely elongated. Taking measurement from the external malleolus to the os calcis, the distance was approximately 1 to 1½ cm. on the injured foot, while on the healthy foot the same distance was 3 cm. The distance measured from the inner malleolus to the tip of the great toe was greater on the injured than on the healthy foot. I advised taking a Röntgen-ray picture from three directions, to clear up the diagnosis, and found the conditions as demonstrated in the accompaning plates.

Number 1 was taken in an antero-posterior direction and showed the fracture of the external malleolus. Nos. 2 and 3 were taken from the inner and outer side respectively and demonstrated that we had to deal with a fracture of the astragalus and subastragaloid forward dislocation of the foot. As four

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months had elapsed since the date of the accident, I did not take the bloody reduction into consideration, but advised the removal of either a part or the entire astragalus, to overcome the deformity and to make the foot useful.

I used an incision extending from 6 cm. above the external malleolus down parallel to its posterior border to the tip of the external malleolus, from there in a curved direction to the middle of the foot on its dorsal side. As both peronei tendons were crossing the field of the incision and could not be retracted sufficiently to clear the field of operation, these were divided. Then the entire astragalus was removed with great difficulty, owing to the dense adhesions that had formed; the peronei tendons sutured and the wound partially closed and partially drained. A plaster-of-Paris cast was then applied with the foot standing in an overcorrected position.

Ten weeks after the operation he was able to walk about and four months later, when he did not receive any more money from the insurance company, the slight pain of which he still complained disappeared and he took up his difficult work as a miner again. A movable joint has formed between the external and internal malleolus and the os calcis.

The position in which the foot is standing now, is shown on Plate No. 4.

Epicrisis.—Subastragaloid dislocation of the foot is of rare occurrence and was first described by Nélaton in his " Surgical Pathology." The condition has been frequently mistaken for dislocation of the astragalus, and Broca was the first (1853) to show that subastragaloid dislocation must be strictly differentiated from dislocation of the astragalus. Deetz (Deutsche Zeitschr. f. Chirurgie, Vol. 74, p. 581) has recently collected all cases of subastragaloid dislocation of the foot, cited in the world's literature. To avoid unnecessary repetition I refer the reader to this article in regard to literature on this subject. Deetz found that subastragaloid dislocation to the inner side is most common; twenty-eight cases being reported. Twenty-five cases of subastragaloid dislocation to the outer side are reported in the literature; twelve cases of backward dislocation and only six cases of forward

FIG. 1.—Fracture of Astragalus and Subastragaloid.   Forward dislocation of the foot.
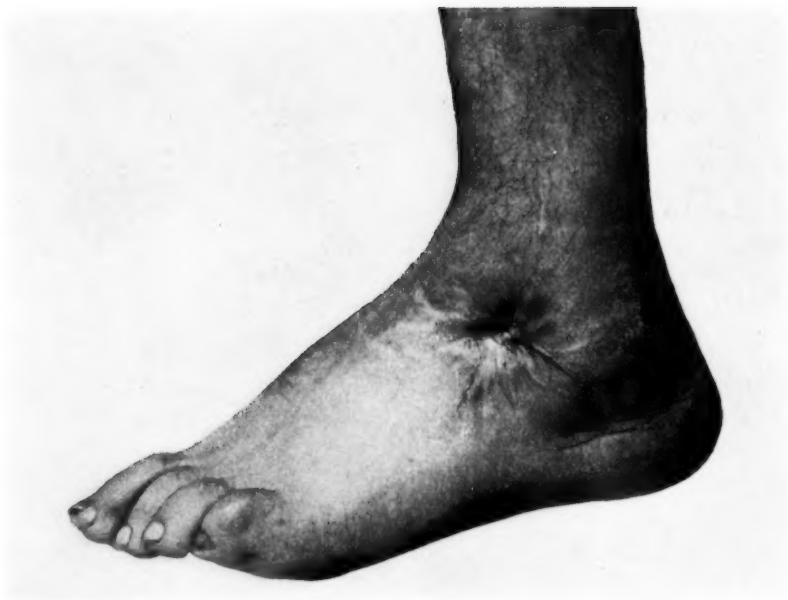View from outer side.   Op. 2, 3, 1904.

FIG. 2.—Fracture of Astragalus and Subastragaloid.   Forward dislocation of foot.
Results after removal of Astragalus.

dislocation of the foot, to which he adds a case of his own. From these last seven cases, three,—*i. e.,* those reported by Parise, Petit and Planteau, were simple cases of subastragaloid dislocation without fracture of the astragalus, while the four others reported by Guenzerich, Sick, Mailland and Deetz, were complicated by a fracture of the astragalus. My case therefore would be the fifth case of subastragaloid forward dislocation of the foot with fracture of the astragalus, and is furthermore complicated by a fracture of the external malleolus.

That fractures of one or both malleoli are not so seldom complicated by partial or total fractures of the astragalus, has been proven since the enlightening of the dark field of fractures by the Röntgen ray.

In but one case of the seven cases of subastragaloid forward dislocation of the foot it was necessary, as in my case, to resect the entire astragalus because of the long standing of the deformity. This case (operated on by Kuester) is cited by Guenzerich, already mentioned above. The deformity existed, in this case, six months before the patient entered the hospital.

In regard to the cause of subastragaloid forward dislocation of the foot, the patient in nearly all cases gives the following similar anamnesis:

The patient seeing that he is falling from an exposed height such as a ladder or rock, jumps to save himself, backwards, or sideways and backwards, then lands with his heels on the ground, tumbling over backwards or forwards, with the foot standing in dorsal flexion. In my case it was difficult to get any definite history, since the patient spoke the Finnish language only.

Diagnosis.—The diagnosis is at times very difficult, due to the enormous swelling and intense pain in the ankle joint and surrounding parts. However, the lengthened dorsal aspect of the foot, so characteristic in all cases of subastragaloid forward dislocation, should always suggest the diagnosis, particularly if, as should be done, comparative measurements are made on the sound foot.

As the corpus of the astragalus is still in contact with the external and internal malleolus, some mobility in the ankle joint must naturally be present, providing the malleoli are not injured or fragments interposed at the same time.

In our days, with the Röntgen ray at our disposal, it is not only desirable but absolutely necessary for a scientifiic diagnosis and treatment to have a Röntgenogram of the fracture taken from several directions.

However as not every practitioner has easy access to a Röntgen-ray coil, the clinical symptoms of fractures ought by no means to be neglected in our teachings.

Treatment.—In recent cases of subastragaloid forward dislocation of the foot, reduction of the dislocation must be tried at once under anæsthesia, and can usually be accomplished by strong dorsal flexion of the foot. If this does not bring about the reduction on account of the interposition of fragments or muscular tissue or parts of the capsule, the bloody reduction without or with the removal of the interposing fragments will usually be followed by excellent results.

In cases of long standing, such as my case and the one cited by Guenzerich, nothing less than the entire removal of the astragalus is sufficient to overcome the mal-position of the foot, and, as the ultimate result in both cases has proven, may give excellent functional results, a new joint forming between the two malleoli and the os calcis.

TRANSACTIONS

NEW YORK SURGICAL SOCIETY.

Stated Meeting, November 8, 1905.

The President, Dr. Howard Lilienthal, in the Chair.

INTESTINAL OBSTRUCTION; FROM ADHERENT MECKEL'S DIVERTICULUM.

Dr. Charles L. Gibson presented a boy, four years old, who was admitted to St. Luke's Hospital on October 21, 1905, with a history dating back five days, when he was seized with sudden vomiting which soon became continuous. No cause for this could be assigned.

When Dr. Gibson saw the boy he was in a condition of collapse, with a temperature of 99 F., and a pulse of 136. The abdomen was much distended. It was opened in the median line, and an obstruction of the lower portion of the ileum was found. The collapsed segment of the gut led to a Meckel's diverticulum, and upon investigation it was found that the obstruction was not caused by the diverticulum itself, but by an adhesion extending from the mesentery to the diverticulum. This was divided, and although the involved section of the gut seemed to be in pretty bad condition, the circulation gradually returned, and the boy made an uneventful recovery. The Meckel's diverticulum was about the size of the last joint of an adult finger, and was situated eight inches from the ileo-cæcal valve.

In reply to a question, Dr. Gibson said he did not remove

the diverticulum, as it was not the direct cause of the obstruction, and as the child was apparently moribund at the time of the operation.

DR. CHARLES N. DOWD asked whether any of the members had ever seen a case where a constriction of the intestine had resulted from the obliteration of Meckel's diverticulum? He had recently operated upon a case in which a constriction existed there. Whether it was temporary or not could not be determined, but it persisted during the half hour that the operation lasted.

DR. ROBERT H. M. DAWBARN said he did not think the complication suggested by Dr. Dowd was ever likely to occur. The diverticulum nearly always sprang from a section of the gut (the ileum) the contents of which, according to Murphy, were invariably fluid. In the large intestine, the contents of which were comparatively solid, obstruction was much more apt to occur. When the Murphy button was first brought out, the objection was made to it that the small opening it left would be apt to become obstructed, while as yet the button had not become detached, and in answer to that criticism, Dr. Murphy published the results of a series of experiments and made the assertion that the contents of the small intestine were invariably fluid, and for that reason obstruction in that region of the bowel, need not be feared.

DR. LILIENTHAL said that a few months ago he was called to see a girl six years old who had just recovered from the whooping-cough, during the course of which she had had attacks of abdominal pain. When the speaker saw her, she had been very sick for two days. The bowels had moved after castor oil. There was some abdominal distention. The temperature was not particularly high, and the child's parents were very much averse to operation. She was, however, sent to the hospital, and immediately after her admission she went into a state of collapse.

Upon opening the abdomen, which was done without delay, Dr. Lilienthal said he came upon a Meckel's diverticulum about five inches long, and characteristic in appearance. It was turned under a fold of mesentery, and adherent somewhere in the right loin. The belly was full of bloody fluid, and the area of gangrene had extended up to the small intestine.

On account of the poor condition of the patient, nothing was

done but to draw the diverticulum into the wound, and make a quick entero-enterostomy with rubber ligature between the two legs of the involved loop. The patient died a few hours after the operation.

In this case, the speaker said, we had an organ much larger than the appendix completely gangrenous, and yet the symptoms were so mild until the child went into collapse that the advisability of an operation was doubtful.

CARCINOMA OF THE MALE BREAST.

Dr. Gibson presented a man, 67 years old, whose previous and family history was unimportant, with the exception of the fact that ever since he could remember he had a small lump in the left breast. Five years ago this had begun to increase in size, and a year later it began to ulcerate.

When the patient was admitted to the hospital, on October 2, of the present year, he presented a large, ulcerating mass firmly fixed to the chest wall. There was marked involvement of the axillary glands, and the outlook did not appear very hopeful. An operation was done, at which, in addition to separating the tumor from the chest wall, it became necessary to remove part of the intercostal muscles. The condition of the patient did not permit of immediate skin-grafting, and the wound was now healing by granulation.

Dr. Gibson said that this was the first case of carcinoma of the male breast upon which he had had occasion to operate. The case was also interesting because it illustrated the fact that benign tumors occasionally became malignant.

Pathological diagnosis: Alveolar carcinoma.

In reply to a question, Dr. Gibson said that he could offer no theory as to the origin of the cancer in this case. There was no history of irritation at the nipple: nothing but the tumor in the upper quadrant of the breast, and that had been there since childhood.

Dr. Lilienthal said he had operated on one case of carcinoma of the male breast in which the patient distinctly traced the condition to the constant irritation of a suspender-buckle, which occasionally caused his nipple to bleed, and which might have had some etiological bearing. That patient was a man

about thirty years old. He always wore soft flannel shirts, and the buckle of his suspenders rested right over the nipple.

Dr. Arthur L. Fisk said that some years ago he saw a carpenter with carcinoma of the breast which was supposed to have been produced by the pressure of the stock of a bit against his left breast. The breast was excised.

Dr. Dowd mentioned a case in an actor who for a long time had played a part in which it was necessary for him to repeatedly strike himself on the breast with his fist.

Dr. Lilienthal called attention to the fact that these traumatisms may have only aggravated a pre-existing tumor.

Dr. Fred Kammerer said that he had operated on several cases of carcinoma of the male breast in which the disease proved to be of rather a malignant type.

EXCISION OF THE UPPER JAW.

Dr. Otto G. T. Kiliani presented a girl of twenty years, who developed a hard tumor of the right upper maxilla, which was first noticed about four years ago. The tumor gradually increased in size, and an operation for its removal was undertaken on October 16, 1905. Preliminary to the operation, the right external carotid artery was ligated, and the enlarged glands in the neck removed. He then made a resection according to Kocher, somewhat modified to prevent a disfiguring scar, and extirpated the entire upper right maxilla. There was no resulting facial paralysis, and the cosmetic effect was excellent, and would be further improved by the ultimate insertion of a proper plate. The pathologist reported that the tumor was a fibroma, and absolutely benign.

Dr. Robert H. M. Dawbarn said in approving of the external carotid ligation performed in this case, the New York Surgical Society had not put itself definitely on record in regard to the advisability of ligation of this artery as a preliminary step to certain otherwise very bloody operations on the face, and that even an excision of the upper jaw was resorted to by some operators without such a preliminary measure. In so prominent a work as " Butlin upon the Surgery of Malignant Growths," that author nowhere advocates preliminary ligations, and seemingly retains as many surgeons still do the fear of secondary hemor-

rhage from the external carotid, if tied; a fear based upon the close order in which its branches are given off—leaving no place for formation of an internal clot.   Dr. Dawbarn said he had ligated the external carotid over one hundred times in living subjects, without encountering any secondary hemorrhages at all. The subject had come up for discussion at the recent meeting of the Pennsylvania State Medical Association, at Scranton, and Dr. Crile, of Cleveland, had made the statement that in a few instances sudden death had followed the operation; he did not say, however, that the cause of death in those cases was secondary hemorrhage.   Dr. Dawbarn said, that in his opinion, ligation of this artery is, in experienced hands, practically without mortality, and that these were cases in which the internal carotid was tied by mistake.   He recalled such a case occurring at the New York City Hospital at his own hands, early in his experience, where the unintentional ligation of the internal carotid by himself in mistake for the external was followed within a few hours after the operation by coma and a rapidly developing lobar pneumonia, with death within two days.   This latter strange complication, the speaker said, he had subsequently learned was mentioned by Erichsen in his work upon surgery as an occasional ill-explained result of tying the internal carotid.   The only way in which this error could be avoided was to find, before tying, a perfectly frank bifurcation of the common carotid; *i.e.*, one giving off branches in the neck, the other not doing so.   In the fatal case for which he had been responsible, Dr. Dawbarn said, an inequality of the pupils was noticed shortly after the operation; and if recognizing promptly the significance of this striking fact, the wound had been immediately re-opened, and the ligature removed, which had been tied of course but gently about the internal carotid, the circulation in the brain might have been restored, and the patient's life probably have been saved.

It seemed to the speaker well worth noting that the commonest anomaly in man, is the rule in dogs: namely, that there is no external carotid, but, instead, the internal on its way to the brain gives off all the branches usually arising from the external carotid.   In such a case it is plain that although control of the seeming external carotid would stop the pulse over the facial and superficial temporal arteries, this, the usual test given in the

text-books, would be valueless, might well cost the patient his life, and as a further blunder might easily be recorded by the operator as a death in consequence of ligation of the external carotid.

DR. KAMMERER said the mistake of tying the internal instead of the external carotid, to which Dr. Dawbarn had referred, could be avoided, and therefore did not count against the operation. The speaker said he had resorted to preliminary ligation of the external carotid in a number of operations on the upper jaws. In one instance, a temporary resection of both superior maxillæ (Kocher), he had tied both external carotids with excellent result.

DR. LILIENTHAL called attention to the advisability of the surgeon calling in a dentist before operating on a case of this kind. If the dentist was given the opportunity of looking over the ground beforehand, he knew about what he had to do and could get his mechanical appliance pretty well under way, whereas if we waited too long, the fitting of a prosthetic apparatus might be attended with difficulty. The speaker said he had seen cases where the deformity left after removal of both upper maxillæ was absolutely uncorrectable.

DR. KILIANI in closing, said that his patient had for a time after the operation complained of a severe unilateral headache on the side where the external carotid was ligated. It had eventually disappeared entirely. In reply to Dr. Lilienthal's suggestion, Dr. Kiliani said that a dentist had been called in to see the patient before the operation, but he had offered no suggestions, and said he would do nothing until the jaw had been removed.

THE VALUE OF WOLFE GRAFTS AND TENDON-LENGTHENING IN THE TREATMENT OF CICATRICIAL CONTRACTURES.

DR. CHARLES N. DOWD presented a paper with the above title (for which see page 278).

IN connection with his paper, Dr. Dowd presented two patients upon whom he had operated by the method described. The history of these cases was contained in his paper.

DR. DAWBARN said he wished to emphasize the following points in reference to tendon-work only: In splicing ten-

dons, he thought it advisable to remove as much of the sheath as possible. Excepting right at the fold of the finger, where a short portion must be left, the sheath elsewhere was the enemy of the surgeon, and with its free removal there was less plastic exudate to deal with—less gluing fast by teno-synovitis. The use of Johnson & Johnson non-adhesive gold-beater's skin court-plaster to prevent adhesions between the tendons—as first recommended by Dr. Robert Morris. The speaker mentioned two personal cases in which there was sloughing of one of the tendons of the finger not far from its insertion (in one of them for a distance of nearly two inches), and in order to get a satisfactory result he had cut into the wrist high up, near the muscular juncture, and then, after finding the right tendon, it was severed extremely obliquely, so as to make a very long splice, and seizing its end in the other wound (that in the finger) it was drawn down until it came in contact with its opponent on the opposite side (*i. e.*, toward the finger-end) to which it was united by suturing. So far as the speaker was aware this plan has not elsewhere been employed.

Dr. Dawbarn said that in two cases of tendon-grafting, he had used tendons obtained from the leg of a cat. One proved successful; the other was a complete failure; the graft, about an inch long in both instances, having sloughed, in this second trial. However, as tendon is nourished only by vitalized plasma, and not directly by vessels of its own, such heteroplastic grafts deserve a better trial than they have heretofore received.

Dr. Lilienthal said that in his own experience with these cases he had found that the success of the operation depended largely upon the complete excision of all the cicatricial tissue, followed by the application of Thiersch grafts of considerable thickness, but not through the full thickness of the skin. He recalled two cases, one of cicatricial contracture of the axilla and the other of the elbow, following burns, in both of which the parts were firmly bound down. In each case he excised the scar completely, until the motions of the limb were perfectly free, and then, after applying grafts by the ordinary Thiersch method, the arm was put up in the extended position, and in both instances he obtained a perfect result. The Thiersch grafts employed for

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this purpose should not be of the very thinnest kind, nor should they include the full thickness of the skin, as the Wolfe graft did. The removal of the cicatricial tissue should be by thorough excision; simply denuding the surface or scraping away the granulations would not be satisfactory.

Dr. KILIANI said that in the case of the child with the contracture of the elbow shown by Dr. Dowd he would be interested to learn how the Thiersch grafts behaved after two years had elapsed. Fifteen years ago, in the case of a severe burn on the inner surface of the arm, he had applied skin-grafts by the Thiersch method, and within four months the grafts had shriveled up to such a degree that they were removed without difficulty, while at the same time the sound skin had stretched to such an extent that its edges could be brought together. The speaker called attention to the fact that the skin-grafts contained no elastic fibres, and on that account shrinkage occurred.

Dr. DOWD, in closing, said he had seen very annoying shrinkage occur in Thiersch skin-grafts, and for that reason thought it better to employ grafts of greater thickness. Kennedy's case, above referred to, is an important illustration of the relative value of the two varieties of grafts. He had employed the Thiersch and the Wolfe grafts side by side, marked contracture occurred in the former, but not in the latter. He believed that in the majority of cases of cicatricial contractures about joints the Wolfe grafts were much better than the Thiersch.

THE VITALITY OF RUBBER; WITH A NEW DEVICE REGARD-
ING ITS LONGEVITY.

Dr. DAWBARN said that he had investigated this subject, which was of some moment to the surgeon, and he had been informed by dealers that one of the best methods of preserving rubber articles was to keep them immersed in water. Of course, grease of any sort is fatal to rubber, as every one knows. Exposure to air, and quiescence, too, resulted in commencing crystallization, which was the beginning of the death of rubber. Many years ago, Dr. Gerster had informed him that in order to prolong the life of his rubber tourniquet, whenever he opened the closet where it was kept he took occasion to give it a good stretching. All bicycle-repair men advise, too, that a rubber tire should be

kept pumped up as hard as possible during the winter months of the bicycle's disuse; and that persistent deflation soon results in a rotten tire.

Obviously, maintenance of a persistent slight pull, to keep a rubber tube " awake," is better than semi-occasional stretchings at irregular intervals. And the object of these remarks was to show to the Society a pair of clamps, obtained from Ermold & Co., in this city, by which without cutting into the rubber the two ends of the large tubing we use for cording limbs are seized. One of these clamps is caught over a nail high in the closet; the other at the lower end, has a light weight attached to it. Thus the tubing is always subject to some little degree of tension.

TRANSACTIONS

OF THE

PHILADELPHIA ACADEMY OF SURGERY.

Stated Meeting held November 6, 1905

The President, HENRY R. WHARTON, M.D., in the Chair.

SARCOMA OF THE BREAST IN A GIRL OF ELEVEN YEARS.

DR. WILLIAM L. RODMAN presented a girl of eleven years upon whom he had operated for sarcoma of the breast. Through an unaccountable oversight the specimen was thrown away by the clinic attendants and hence a microscopic examination could not be made, but from the clinical history and the microscopic appearance of the specimen there seemed no doubt that it was a sarcoma. Certainly it was a neoplasm and was not encapsuled. Nearly a year ago the patient struck the breast, the injury being followed by pain. She was treated in the dispensary of the Jewish Hospital from Easter until September, the pain persisting and the growth increasing in size. When Dr. Rodman saw the patient, the growth was evident and was reasonably hard. Immediate removal was advised because the pain was increasing and also because of the large veins which ran across the tumor; he has never seen such veins in anything but a sarcoma. Three weeks ago the entire breast, including a large area of skin, was removed; the incision was carried well into the axilla but no enlarged glands were found. Sarcoma of the breast at any age is rare, there being ten or more carcinomas to one sarcoma. Dr. Rodman has not seen another case in so young a girl but recalls the reporting by Dr. Dugan, of Louisville, of a sarcoma in a girl of eight, and still younger have been observed; he had never before seen a neoplasm of any kind in so young a child.

LAMINECTOMY FOR PARAPLEGIA THE RESULT OF TUBER-
CULOUS DISEASE OF THE SPINE.

DR. RICHARD H. HARTE presented a man aged twenty-six, who was admitted to the Orthopædic Hospital on September 5, 1904. There was no tuberculous family history obtainable. He had suffered from pneumonia two years previous, had scarlet fever when five years old and diphtheria when seven. 1896, when nineteen years old, he had typhoid fever which was complicated by phlebitis in both lower extremities, the right leg being the first affected. After three months of convalescence the leg ceased to swell. In 1898 he entered the army and in the course of his duties he fell and struck his left kneecap. The injury was not severe but there was much swelling and considerable pain. On June 29, 1898, he was admitted to the Pennsylvania Hospital under the care of the late Professor Ashhurst, with a diagnosis of tubercular disease of the left knee joint. Some iodoform emulsion was injected into the joint and a month later an abscess, apparently tuberculous in character, formed on the inner side of the right arm; this was opened and drained. Three months after his admission to the Pennsylvania Hospital the patient's knee condition improved and he left the institution walking on crutches. In the following May he returned to the hospital for examination and was under Dr. Harte's care. His limb was in good condition and he had a fairly useful knee and was allowed the use of his leg. After this date he states the abscess in his arm opened again and the shoulder became stiff. Two years later he was readmitted to the Pennsylvania Hospital and the knee joint was found to be so badly diseased that palliative treatment was no longer considered, and the limb was amputated by Dr. Hopkins in the lower third of the thigh, on October 23, 1901. The patient made a good recovery from the operation and returned to his home. Shortly after this he noticed a lump the size of a hickory nut on the lower dorsal region of the spine. He complained of pain in the lumbar region and was treated for lumbago. He was not seriously incommoded until June, 1904, when he began to suffer from what he described as " remittent fever." He was confined to bed for two weeks, and when able to be up noticed a numbness which he had felt for some months about his hips and which

increased so that his foot was numb; in a short time he entirely lost the use of his body and limbs below the waist line.

He was admitted to the Orthopædic Hospital in September, 1904, paralyzed from the waist down. Sensation was markedly impaired throughout the affected area. He had incontinence of urine and feces and a very severe grade of cystitis. The stump of the amputated limb was in good condition. There was very marked kyphosis in the lower dorsal region. Every effort was made to relieve the annoyance due to the incontinence; extension was applied to head and right leg and the bladder thoroughly irrigated twice daily. After about two months of treatment the sensation improved and the incontinence and cystitis disappeared. At this time he was able, with effort, to slightly move the great toe. He remained in this state for about five months and no further improvement seemed probable; the question of laminectomy was then considered. He was examined by some of the neurological staff of the hospital, who advised against operation. Nevertheless, on April 27, 1905, nearly eight months after his admission to the Orthopædic Hospital, with his desire, laminectomy was undertaken, although a cure was not looked for. The spines and laminae of the ninth, tenth and eleventh dorsal vertebræ were removed, thus thoroughly exposing the cord so that it could be approached from all sides. Considerable extradural tuberculous material was removed and the anterior portion of the neural canal curetted and made as smooth as possible. Practically no shock attended the operation and on recovery from the anesthetic the patient expressed himself as being able to feel the bed beneath him in a much more natural way than before operation. He was put to bed with extension and counter-extension to the head and extremity. The wound convalescence was uninterrupted. Gradually increased power in the great toe was developed and at the end of four weeks sensation was perfect all over the lower extremities. The toes could be flexed, the ankle-joint, right knee and amputated left thigh could be moved at will, although markedly ataxic. On July 1, three months after operation, a plaster cast was applied. This was worn until about September 21, when it was replaced by a brace. Since that time his ability to walk has steadily increased, until now, seven months after operation, he is able to walk as well as the average one-

limbed person, although he is necessarily handicapped in the use of his crutches by the brace. The first of October he developed a small abscess in the right shoulder, which was evacuated and soon healed.

In this case it would seem that ample time had been allotted to treatment by rest, extension, etc., and that if this mode of treatment was to be pursued further valuable time would be lost and degenerative changes would soon be manifested in the cord, which would materially interfere with the results from any operative measure which might be determined on at a later period. Operative treatment in this class of cases is much more applicable in adults than in children. In the latter most brilliant results can be obtained by extension, pressure, etc., as the age, anatomical conditions, etc., lend themselves more readily to this mode of treatment. In adult cases it is Dr. Harte's judgment that after a reasonable period of rest and extension in bed, if no positive results manifest themselves after, say, from four to six months, more positive and radical measures should be considered. He was inclined to think that the paralysis and symptoms occurring in this class of cases are due in a great measure to tuberculous and inflammatory deposits, thickening of the membrane in and about the canal, and that their removal by a laminectomy will give a thorough exposure of the cord and its membranes, both anteriorly and posteriorly, and will thus offer the best means of relief. This procedure should be carried, if necessary, even to the severance of some of the spinal nerves so that the operator can be positive that no point of pressure has been overlooked. In a very small percentage of cases will any bony or angular compression of the cord be found. The region of the spine most prone to these affections would naturally be the dorsal, where the lumen of the canal is more restricted and where a small degree of thickening will be followed by pressure symptoms. It is a well-known clinical fact that many severe grades of paraplegia may recover though great angularity still exists, provided the tuberculous and inflammatory deposits are absorbed.

A number of years ago the brilliant results reported by McEwen, Horsley, and others led the profession to believe that almost every case of spinal carious paraplegia would be cured by operation. As a result many cases were operated upon with

disastrous results. The operators failing to recognize that in addition to the local condition, their patients were afflicted with a weakening constitutional disease when the reactive condition was very low and where operative conditions were contraindicated.

With regard to the operative technique Dr. Harte had found that the best incision is one directly down on the top of the spinous process quickly separating the muscles and thoroughly exposing that portion of the column. For a few minutes violent hemorrhage will result, but this is is easily controlled by pressure. After a thorough exposure of the laminæ by removal of the spines with a large bone forceps a trephine can be applied and the neural canal thus carefully opened. After the exposure of the cord the other parts of the canal can be easily removed with a pair of Rongeur forceps. The trephine seems to be the simplest means of entering the neural canal, and after the removal of the disc the later steps of the operation are comparatively easy, little difficulty being experienced in exploring and examining the cord. In closing the wound deep buried stitches of chromicized catgut should be employed, insuring accurate approximation of all the overlying tissues, thus doing away with any possible dead spaces for clots to collect in and favor suppuration. The wound is preferably drained with gauze, as its contact with the cord is not liable to cause any undue pressure, which might possibly arise from the use of a drainage tube.

DR. DEFOREST WILLARD said the exceedingly favorable result obtained in this case by Dr. Harte was undoubtedly due to the thoroughness of the operation, which extended both above and below the principal lesion, and also to the fact that he was able to remove so much tuberculous deposit. If in these cases extensive pachymeningitis be present in addition to the deposit, operative benefits will not be so speedy or so satisfactory. Striking cases like the one shown by Dr. Harte were reported fifteen years ago by Macewen, Horsley and others and as a result the profession was deluded into thinking that all would give the same improvement. Laminectomy is an excellent operation in favorable cases; in others it is a total failure and relapses are numerous. In the case shown by Dr. Harte relapse is not likely to occur unless the man again becomes tuberculous. Dr. Harte spoke of the care needed in selecting cases and of the feebleness of

certain patients contraindicating operation. A very good illustration of these statements is the case of a boy upon whom Dr. Willard operated recently who for twenty months had lain totally paralyzed from spinal caries. At last motion slowly returned in his legs but as the muscles had contracted so much that he could not bend his ankles, it was decided to divide the tendo-Achillis in order to allow more motion. This was done, the boy, roused from his ether, talked and seemed comfortable, then suddenly died in five minutes in spite of every effort made in his behalf. The result showed the poor general condition of the patient, death following so trivial an operation as division of tendons, with the loss of about three drops of blood and with an etherization of only a few minutes in a patient with no discoverable renal or cardial disease. These are cases that die after laminectomy.

DR. JAMES K. YOUNG said that Dr. Harte had very carefully selected his case in this instance, and hence had met with success.

The difficulty in selecting cases lies in the recognition of the pathological process which is present in an individual case. Only 2 per cent. of paraplegias are due to bone pressure and 25 per cent. to tuberculous masses, the majority being caused by pachymeningitis. These patients should be operated on early, and they are in England, but not early enough here, especially by orthopedic surgeons. The operation is often delayed until complete loss of sensation has existed for a long period, and until every other known means of treatment has been exhausted. Often they are allowed to continue without operation more than four or six months. Early spasticity and early contractures are indications for early laminectomy, no other symptoms being so urgent. In all cases where it is possible the anterior portion of the spinal canal should be carefully examined. The removal of tuberculous masses from the anterior portion of the cord is difficult and it is only in adults that it can be accomplished. The incision employed by Dr. Harte is the best of the various ones in use.

TWENTY-ONE GUNSHOT PERFORATIONS OF THE SMALL
INTESTINES WITH RECOVERY.

DR. WILLIAM L. RODMAN reported this case, showing a specimen of six inches of jejunum containing three large perforations which was resected.

THE TREATMENT OF PERFORATIVE PERITONITIS.

DR. ROBERT G. LECONTE read a paper with the above title (for which see page 231).

DR. JOHN H. GIBBON said that the method described in Dr. LeConte's paper was a direct opposite of that advocated by many surgeons, in which the entire peritoneal cavity is thoroughly flushed and all of the lymph removed from the intestines. It is thought that many cases are lost because surgeons do not adhere strictly to either of these methods, that, is either a half-hearted irrigation is done, or else in trying to follow the Murphy plan too much is done.   Murphy not only places these patients in the Fowler position after operation but has them brought to the hospital and placed upon the operating table in this same position.   Dr. Gibbon stated that he had failed to introduce the large quantities of salt solution which Murphy recommended.   He has employed the method in other respects in five or six cases with most saisfactory results.   He lost one case treated in this way a few days ago but believes that the patient died from a pulmonary embolus.   Since reading Murphy's first paper two years ago Dr. Gibbon has used much larger quantities of salt solution but states that after every abdominal section which he has ever done he has used either plain water or salt solution in the bowel.   He learned this from Baer, who advocated it strongly fifteen years ago.   Dr. Gibbon strongly urged the employment of the Ochsner treatment *after* the removal of the appendix; he believes that frequently cases die from a spreading peritonitis the result of an active peristalsis.   He always gives his abdominal cases morphia before they come out of ether; this he also learned from Baer, and has employed it in every case. The patients are much quieter during their recovery from the anesthetic and are much more comfortable.   Many of the cases require but the one dose of morphia.   If, however, the patients are restless, and if peristalsis is to be avoided the morphia is repeated.

Dr. Gibbon is now watching four cases of diffuse peritonitis treated after the plan of Murphy, with the exception that the enemata of salt solution were not so large, and in which not a single suture was introduced in the wound.   Incision was made through the right rectus.   Three of these patients are entirely well and show no evidence of a hernia.   Where no sutures are

introduced it is believed that the rectus incision is a much safer one than those which are more nearly over the appendix region. Another exception to the Murphy technique which Dr. Gibbon made in all of his cases is that of gauze drainage instead of tube drainage. He is careful to carry a large gauze drain back of the bladder, another to the right iliac fossa and a third into the right kidney pouch.

DR. RICHARD H. HARTE said that there were two classes of cases with which the surgeon is constantly coming in contact: First, where the infection is diffuse and very acute and which when opened and drained invariably do well; second, those in which a similar condition has remained from twenty-four to forty-eight hours, during which time the toxic influences have been increasing enormously until the patient is profoundly poisoned, and his powers of resistance materially impaired. In the latter class when operated upon the prognosis is always exceedingly grave it being impossible to say just what amount of toxine these patients can stand. It is here that most of the failures are to be found. There is no doubting the fact that the method of Murphy, as emphasized by Dr. Le Conte, of keeping the bowel full of water, is an exceedingly good one, and its employment often decides between failure and success in the treatment of these cases. For many years Dr. Harte has pursued practically this method of treatment and has long appreciated the good results which come from it. He also is thoroughly convinced of the importance of keeping food away from patients after operation, as the too early ingestion of food is bound to be followed by fermentation, distention, etc., thus adding materially to the discomfort of the patient.

DR. LE CONTE, in closing, said in reply to Dr. W. Joseph Hearn, who asked him to report the results of the Murphy treatment in cases of peritonitis of several days' duration, that persons are usually dead that length of time after perforation and he does not see them. If they do live for days, adhesions are generally found enclosing pus in pockets and these adhesions need to be broken up. Where pus is free in the peritoneum the method of Murphy gives only the best possible chance of recovery. The operation lasts but a few minutes, the amount of fluid in the blood vessels is increased, which stimulates the heart, and above all, by

its introduction into the rectum, the fluid changes the current of the lymph stream and prevents absorption of septic products. If the patient be in the typhoid state, as was one of those reported by Dr. LeConte, he believes much obnoxious material is passed out by the increased flow of urine from the kidneys. Usually only 12 to 15 ounces of urine are passed the first day after an abdominal operation, while in the case mentioned, 65 ounces were voided. This cannot be other than a great aid in eliminating toxic products. In answer to a question by Dr. Taylor regarding the length of nozzle for introducing salt solution into the rectum, Dr. LeConte said that two inches entrance was sufficient.

CANCER OF THE BREAST: CANCER OF THE CECUM.

DR. WILLIAM L. RODMAN exhibited these specimens. The first is interesting from a pathological and anatomical standpoint, as proving that the pectoral muscles should always be removed when operating for cancer of the breast. He has followed the teaching of Grossman and Ratler as regards the presence of glands between the two muscles, but had never before seen a clear demonstration of the truth of such statements. In the specimen are three enlarged glands between the two muscles, and none of them was seen or felt until the greater pectoral was removed. The glands all lay well below the upper edge of the pectoralis minor.

The specimen of cancer of the cecum was removed post-mortem from a man who had several months ago suffered from chronic intestinal obstruction. He was in a very bad condition when put upon the table, vomiting fecal matter and with a pulse beyond 130. The diagnosis of malignancy had been made some time before and it was quite clear that the only thing which could be done was an entero-anastomosis. When the abdomen was opened the diagnosis of carcinoma was evident, the growth appearing to have originated around the base of the appendix. Nodules of various sizes from a millet-seed to an olive were scattered over the intestines and mesentery. The small intestine was so greatly dilated as to look like the stomach; the cecum was collapsed. A lateral anastomosis between the ileum and the cecum was performed by the clamp method as employed by Moynihan in

gastro-enterostomy. The relief from obstruction was complete, patient living three or four months entirely comfortable so far as the intestinal current was concerned, an opening three inches long was made between the small and large intestines. There were no further symptoms of obstruction at any time during the life of the patient.

DR. ADDINELL HEWSON referred to a case operated upon last June in which he found between the pectoralis major and minor a single tumor the size of a duck egg. It extended from the pectoralis minor backward to the vessels. Both pectorals were removed. Subsequent microscopic examination showed the tumor to be a cancer. Concerning the anatomical relations of the part there are two chains of lymphatics, one to the breast proper, the other to the pectoral muscles themselves. These two chains join before emptying into the general axillary chain of glands and the growth described was situated at the junction of the two chains. Dr. Hewson has never seen glands situated so high as are those shown by Dr. Rodman. In his own specimen the growth was directly in the middle of the pectoralis minor. Pressure may have prevented it going higher, the mass from the outside appearing as large as a fist.

As emphasizing the great distention which occurs in the gut in cases of cancer, Dr. Hewson mentioned a case which came to the Oncologic Hospital after having been operated on elsewhere. Through the operation wound in the left groin a soft rubber catheter could be passed to a point between the median line and the opposite groin.

CHEWING GUM REMOVED FROM THE BLADDER.

DR. E. H. SITER showed this specimen, which had been in the bladder four days. It was remarkable chiefly for the large amount of salts adherent to it. The gum had been inserted in the penis to prevent nocturnal emissions.

DR. WILLIAM J. TAYLOR recalled the fact that he reported to the Academy last year an instance of gum in the bladder, it having been inserted in the penis to stop a gonorrheal discharge. This had become encrusted with salts and formed a large stone. Perineal section failed to allow removal of the mass, which was finally secured through a suprapubic opening.

TRANSACTIONS

OF THE

PHILADELPHIA ACADEMY OF SURGERY.

Stated Meeting January 2, 1906.

JOHN B. ROBERTS, M.D., in the Chair.

CARCINOMA OF TONGUE.

DR. W. JOSEPH HEARN, at the request of Dr. W. W. Keen for whom he had operated, presented a deaf and dumb Russian girl who nine months previous to the operation noticed on her tongue a nodule the size of a cherry. She was for some months put on antisyphilitic treatment being in two hospitals, although no history of syphilis could be obtained. Under Dr. Keen's care a section of the growth, which had become much larger, was removed and microscopic examination showed it to be an epithelioma. The entire tongue was removed by the Regnoli-Billroth method, the incision extending from one angle of the jaw to the other and then down on either side to clear the neck of its glands. Both lingual arteries were tied. The tongue was held forward by the customary ligature in the anterior portion and in addition two ligatures were inserted near the base to afford better control of that part of the organ. The tongue was divided at its junction with the epiglottis. This left a very short stump which at once fell back, raising a difficulty as to its disposal. It was finally sewed to the remnants of the muscles of the mouth which were barely one-half inch long, the muscles being then included in a subcutaneous stitch under the jaw. The patient

has done very well since the operation, gaining 23 pounds during the seven weeks. The pathologist's report on the removed tongue was again epithelioma.

DR. JOHN H. GIBBON said this patient was under his care for some weeks at the Pennsylvania hospital. Dr. Stewart first saw her and was in doubt as to the nature of the growth on the tongue, that is whether it was syphilitic or malignant. Finally he thought she was not taking the prescribed treatment regularly and sent her to the hospital. There several surgeons saw her and among them there was difference of opinion regarding the nature of the growth. It involved the side of the tongue and the floor of the mouth, the edges being prominent and everted, and was covered by a nasty, greenish-colored slough. A small section of the growth was sent to the laboratory but the specimen was not satisfactory. The patient was put upon mixed treatment—potassium iodide in enormous doses and mercurial inunction. At first there was marked improvement, the growth diminishing in size and the slough separating. The patient was very tolerant of the treatment, there being no evidence of mercurialization except incontinence of saliva and this condition she had, as do all persons with tumor of the mouth, before treatment was begun. The result of the mixed treatment convinced him that the growth was syphilitic and later Dr. Stewart reported that he had obtained a clear history of syphilitic infection. Improvement, however, soon was less marked and the patient finally became disgusted with her progress and left the hospital. The case is of peculiar interest to Dr. Gibbon. He doubts that antisyphilitic treatment would have cured the patient, the case being one of those occasional instances in which operation is necessary. In view of the impunity with which mixed treatment was given and of the undoubted history of syphilitic infection, he is inclined to doubt the character of the growth as announced later. In addition and of great value clinically is the fact that when improvement under treatment occurred and the patient was able to open the mouth ulceration of both anterior pillars of the puces could be seen. These ulcerations healed under the antisyphilitic treatment.

Dr. James P. Hutchinson said he saw the patient with Dr. Gibbon but did not agree in the diagnosis, as he believed the growth to be malignant in character. He was not, however, sufficiently confident of its nature to urge operation and with the other surgeons agreed that mixed treatment should be given. His opinion regarding the malignancy of the growth was considerably shaken by the improvement under three weeks' medical treatment and also by the absence of indications of mercurialization except the salivation which was present before treatment was begun. He did not see the patient again although he heard of Dr. Stewart's statement of an undoubted history of syphilitic infection.

Dr. Hearn, in closing, said it was well known how rarely cancer is engrafted on a syphilitic lesion but if there is one place in the body in which this does occur it is the tongue. He now has under his care a gentleman from whom he had to remove part of the tongue which was cancerous and he believes the lesion originally was due to syphilis. All the glands of the neck in the patient exhibited were enlarged, though the lesion may have been syphilitic. In answer to questions by Dr. Gibbon, Dr. Hearn said he thought there was yet some granulation tissue in the floor of the mouth; the patient has had no constitutional treatment since operation.

Dr. Richard H. Harte delivered the annual address for 1906, his theme being: " The Life and Labors of Dr. Philip Syng Physick."